



Audi

Workshop Manual

Audi A6 2011 ➤

Audi A7 Sportback 2011 ➤

Direct injection and ignition system (8-cyl. 4.0 ltr. 4-valve TFSI)

Engine ID	CEU C	CRD B							
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Edition 12.2012

List of Workshop Manual Repair Groups

Repair Group

24 - Mixture preparation - injection

28 - Ignition system



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24 – Mixture preparation - injection

1 Safety precautions and rules for cleanliness

(ARL003017; Edition 12.2012)

⇒ [“1.1 General notes on self-diagnosis”, page 1](#)

⇒ [“1.2 Safety precautions when working on the fuel system”, page 2](#)

⇒ [“1.3 Safety precautions when working on the injection and ignition system”, page 2](#)

⇒ [“1.4 Safety precautions when working on vehicles with start/stop system”, page 3](#)

⇒ [“1.6 Safety precautions when using testers and measuring instruments during a road test”, page 4](#)

⇒ [“1.7 Rules for cleanliness and instructions for working on fuel system”, page 4](#)

⇒ [“1.8 Reducing pressure in high-pressure section of injection system”, page 4](#)

⇒ [“1.9 Checking for leaks in the fuel system”, page 5](#)

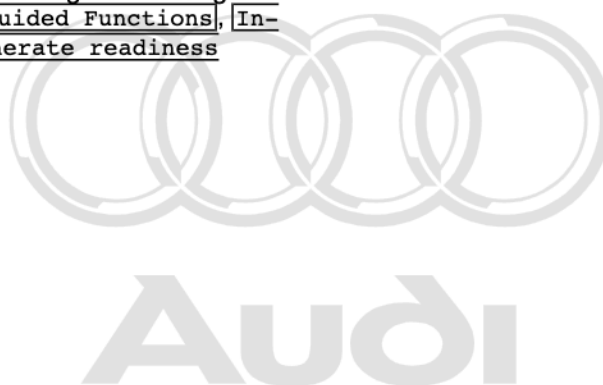
⇒ [“1.10 Checking vacuum system”, page 6](#)

1.1 General notes on self-diagnosis

- ◆ The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.

Additional steps required

- Erase any entries in event memory resulting from testing or repairs ⇒ Vehicle diagnostic tester, Guided Functions, In-terrogate event memory, then Generate readiness code.



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1.2 Safety precautions when working on the fuel system

When working on the fuel system note the following warnings:



WARNING

There is a risk of injury: avoid skin contact with fuel.

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system; for the correct procedure see [⇒ page 4](#).*
- ◆ *The connection must be opened IMMEDIATELY after reducing the pressure; wrap a cloth around the connection and allow the residual pressure (approx. 6 bar) to dissipate.*

Escaping fuel can cause a fire risk.

- ◆ *As the fuel pump is activated by the door contact switch when the driver's door is opened, disconnect the voltage supply for the fuel pump if the battery has NOT been disconnected.*
- ◆ *Remove fuse for fuel pump control unit -J538- → Current flow diagrams, Electrical fault finding and Fitting locations.*

- ◆ Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- ◆ Do not use sealants containing silicone. Particles of silicone drawn into the engine will not be burnt in the engine and will damage the Lambda probes.

1.3 Safety precautions when working on the injection and ignition system

To prevent injuries to persons and/or damage to the fuel injection and ignition system, note the following:

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.
- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ For safety reasons, the battery must be disconnected before opening the fuel system to prevent the fuel pump from being activated by the contact switch on the driver's door.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off ignition before washing engine.



Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 .

1.4 Safety precautions when working on vehicles with start/stop system



WARNING

Risk of injury due to automatic engine start on vehicles with start/stop system.

- ◆ *On vehicles with activated start/stop system (this is indicated by a message in the instrument cluster display), the engine may start automatically on demand.*
- ◆ *Therefore it is important to ensure that the start/stop system is deactivated when performing repairs (switch off ignition, if required switch on ignition again).*

1.5 Safety precautions after working in the engine compartment

After working in the engine compartment, note the following:



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

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1.6 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*

1.7 Rules for cleanliness and instructions for working on fuel system

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Even small amounts of dirt can cause malfunctions. When working on the fuel supply system and injection system, pay careful attention to the following basic rules:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- ◆ Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set -VAS 6122- .
- ◆ Place parts that have been removed on a clean surface and cover them over. Do not use fluffy cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- ◆ When the system is open: Do not work with compressed air. Do not move the vehicle unless absolutely necessary.
- ◆ Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

1.8 Reducing pressure in high-pressure section of injection system

Special tools and workshop equipment required

- ◆ Vehicle diagnostic tester



WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- ◆ *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (4 ... 7 bar).*
- ◆ *Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes or fuel pressure sender -G247-), the pressure in the high-pressure section must be reduced to a specified level. The procedure is described below.*

Procedure

- Connect vehicle diagnostic tester , select function “Reducing fuel pressure in fuel rail” in “Guided Functions” and follow on-screen instructions.
- Fuel pressure will drop to a specified value.
- Switch off ignition.

The fuel rail is still filled with fuel, however it is no longer under high pressure.



WARNING

There is a risk of injury: avoid skin contact with fuel.

- ◆ *Wear safety goggles and protective clothing when opening the fuel system.*
- ◆ *Before opening the high-pressure section of the fuel system, place a clean cloth around the connection to catch escaping fuel.*

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- The high-pressure system must be opened »immediately« after reducing the fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.



Note

- ◆ *The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.*
- ◆ *The ignition must not be switched on again from this point on as this would increase the pressure again.*

Additional steps required

- Erase any entries in event memory resulting from work performed ⇒ Vehicle diagnostic tester, Guided Functions, Interrogate event memory, then Generate readiness code.

1.9 Checking for leaks in the fuel system

- Allow engine to run for several minutes at moderate rpm.
- Switch off ignition.
- Check complete fuel system for leaks.

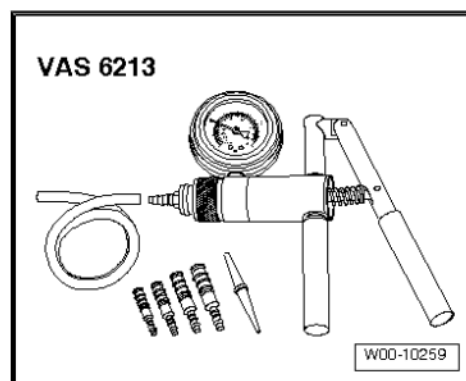


- If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.
- Road-test vehicle and accelerate with full throttle at least once.
- Then inspect high-pressure section again for leaks.

1.10 Checking vacuum system

Special tools and workshop equipment required

- ◆ Hand vacuum pump -VAS 6213-



Procedure

- Check all vacuum lines in the complete vacuum system for:
 - ◆ Cracks
 - ◆ Traces of animal bites
 - ◆ Kinked or crushed lines
 - ◆ Lines porous or leaking
- Check vacuum line to solenoid valve and from solenoid valve to corresponding component.
- If an entry is stored in the event memory, check the vacuum lines leading to the corresponding component and also check the other vacuum lines leading to other components.
- If it is not possible to build up a vacuum with the hand vacuum pump -VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.



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2 Injection system

⇒ ["2.1 Test data", page 7](#)

⇒ ["2.2 Overview of fitting locations - injection system", page 8](#)

2.1 Test data

4.0 ltr. TFSI engine	
Idling speed	Cannot be adjusted; regulated by idling speed stabilisation
Fuel pressure before high-pressure pump	4.0 ... 7.0 bar
Fuel pressure after high-pressure pump	25 ... 120 bar



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2.2 Overview of fitting locations - injection system

⇒ ["2.2.1 Fitting locations in engine compartment", page 8](#)

⇒ ["2.2.2 Fitting locations on engine \(from above\)", page 13](#)

⇒ ["2.2.3 Fitting locations on engine \(from front\)", page 14](#)

⇒ ["2.2.4 Fitting locations on engine \(from right side\)", page 15](#)

⇒ ["2.2.5 Fitting locations on engine \(from left side\)", page 16](#)

2.2.1 Fitting locations in engine compartment

1 - Turbocharger air recirculation valve -N249-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 21

2 - Fuel metering valve -N290-

- ☐ Exploded view ⇒ [page 45](#)

3 - Power unit mounting sender 1 -G748- / power unit mounting actuator 1 -N513-

4 - Charge pressure sender -G31-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 21

5 - Brake servo pressure sensor -G294-

6 - Gearbox oil cooling valve -N509-

- ☐ Fitting location ⇒ [page 11](#)
- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 19

7 - Accelerator position sender -G79- and accelerator position sender 2 -G185-

- ☐ Fitting location ⇒ [page 10](#)

8 - Brake light switch -F-

- ☐ Fitting location ⇒ [page 10](#)

9 - Engine control unit -J623-

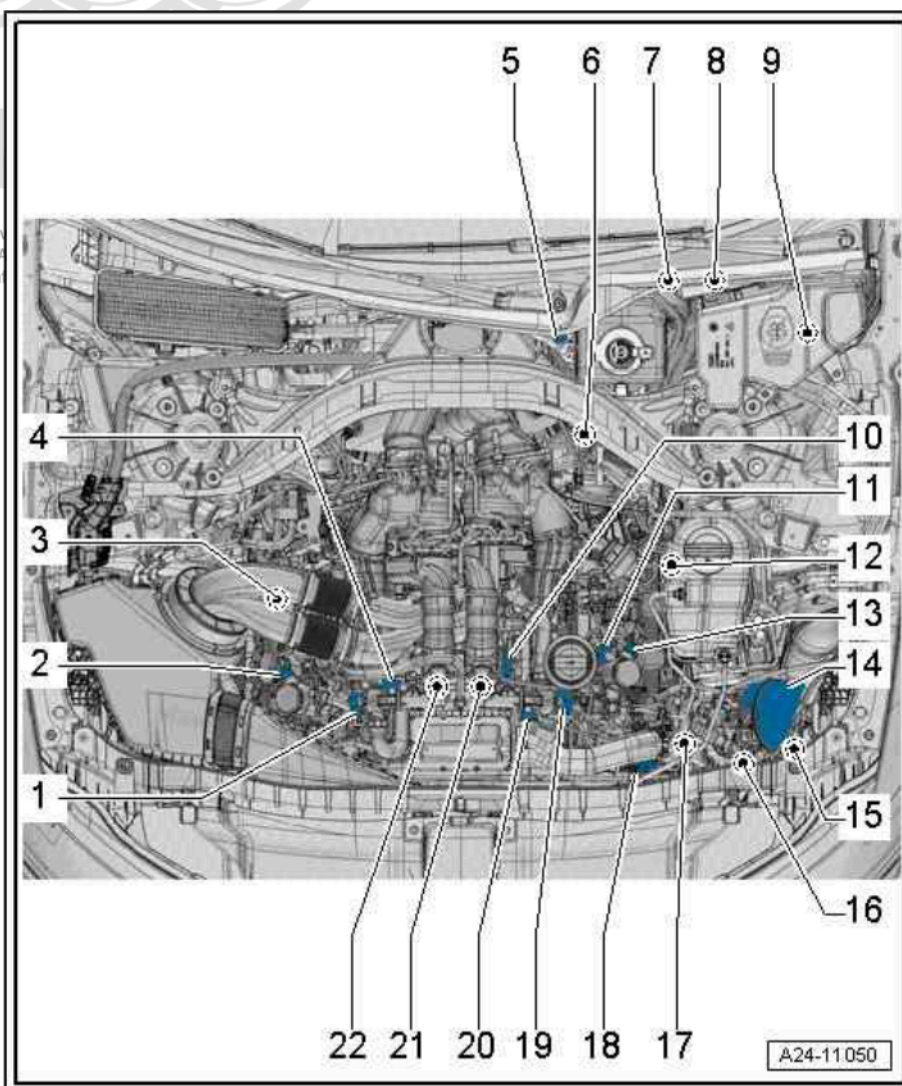
- ☐ Fitting location ⇒ [page 9](#)
- ☐ Removing and installing ⇒ [page 64](#)

10 - Throttle valve module -J338-

- ☐ Including throttle valve drive for electric throttle -G186-, throttle valve drive angle sender 1 for electric throttle -G187- and throttle valve drive angle sender 2 for electric throttle -G188-
- ☐ Exploded view ⇒ [page 23](#)

11 - Fuel pressure sender for low pressure -G410-

- ☐ Exploded view ⇒ [page 45](#)



12 - Power unit mounting actuator 2 -N514- power unit mounting sender 2 -G749-

13 - Fuel metering valve 2 -N402-

- ☐ Exploded view ⇒ [page 45](#)

14 - Secondary air pump motor -V101-

- ☐ Fitting location ⇒ [page 12](#)
- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 26

15 - Continued coolant circulation pump -V51-

- ☐ Fitting location ⇒ [page 10](#)
- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 19

16 - Charge air cooling pump -V188-

- ☐ Fitting location ⇒ [page 11](#)
- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 19

17 - Radiator outlet coolant temperature sender -G83-

- ☐ Fitting location ⇒ [page 10](#)
- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 19

18 - Sender 1 for secondary air pressure -G609-

- ☐ Fitting location ⇒ [page 12](#)
- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 26

19 - Turbocharger air recirculation valve, cylinder bank 2 -N427-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 21

20 - Charge pressure sender 2 -G447-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 21

21 - Temperature sender 2 for charge air cooler -G764-

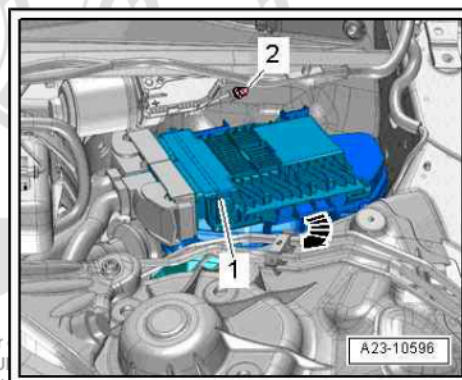
- ☐ Fitting location ⇒ [page 11](#)
- ☐ Exploded view ⇒ [page 41](#)

22 - Temperature sender 1 for charge air cooler -G763-

- ☐ Fitting location ⇒ [page 11](#)
- ☐ Exploded view ⇒ [page 41](#)

Fitting location of engine control unit -J623-

- ◆ -Item 1- in plenum chamber (left-side)



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Fitting location of accelerator position sender -G79- / accelerator position sender 2 -G185-

◆ In accelerator pedal module

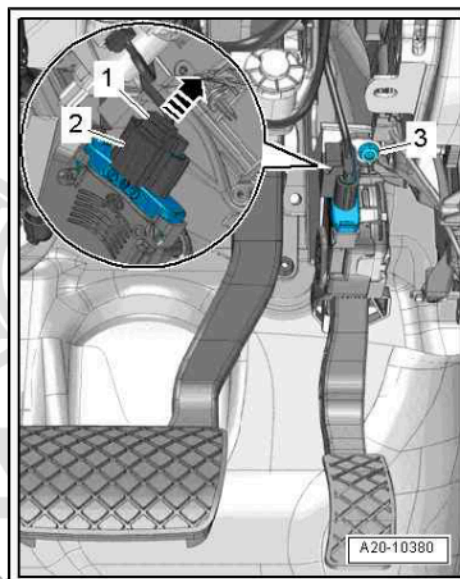
2 - Electrical connector



Note

The accelerator position sender -G79- and accelerator position sender 2 -G185- are integrated in the accelerator pedal module and cannot be renewed individually.

Removing and installing ⇒ fuel supply system; Rep. gr. 20

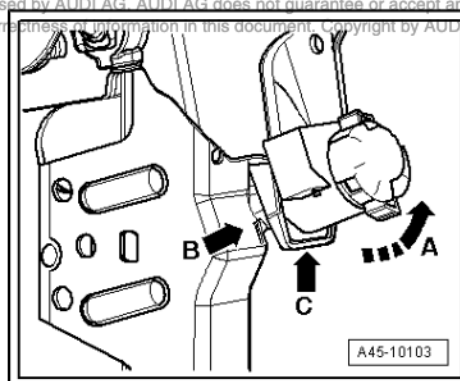


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Fitting location of brake light switch -F-

◆ In footwell on brake pedal

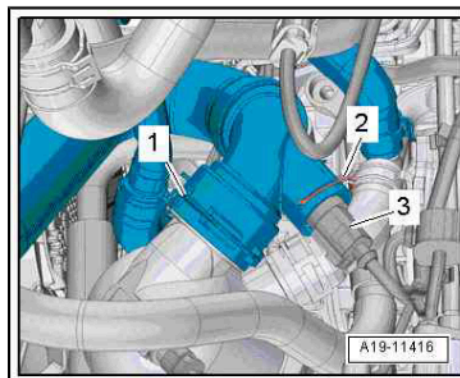
Removing and installing ⇒ Brake system; Rep. gr. 45 .



Fitting location of radiator outlet coolant temperature sender -G83-

◆ In bottom coolant hose (left-side) on radiator.

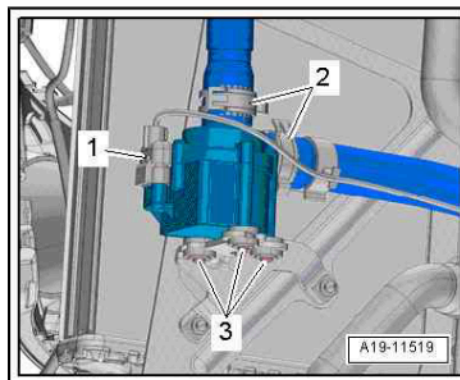
Removing and installing ⇒ Engine, mechanics; Rep. gr. 19



Fitting location of continued coolant circulation pump -V51-

◆ At front left, beneath headlight

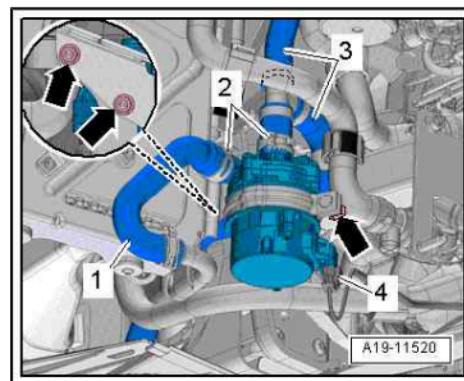
Removing and installing ⇒ Engine, mechanics; Rep. gr. 19



Fitting location of charge air cooling pump -V188-

◆ At front left, beneath headlight

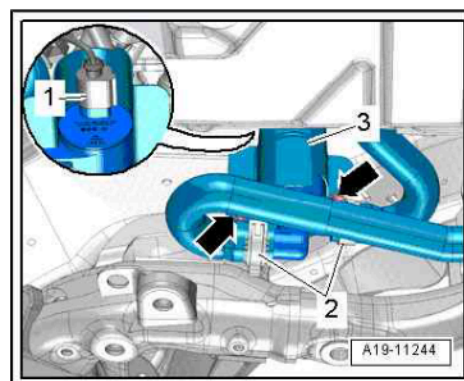
Removing and installing ⇒ Engine, mechanics; Rep. gr. 19



Fitting location of gearbox oil cooling valve -N509-

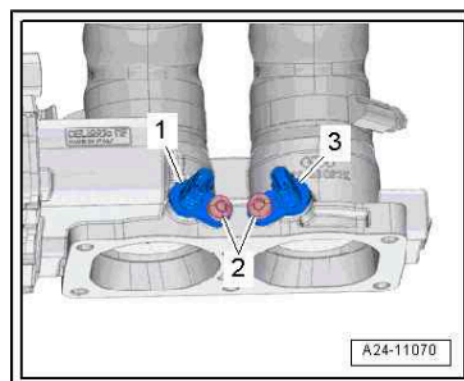
◆ At rear left of subframe

Removing and installing ⇒ Engine, mechanics; Rep. gr. 19



Fitting location of temperature sender 1 for charge air cooler -G763- / temperature sender 2 for charge air cooler -G764-

◆ On throttle valve module -J338- (bottom)



Fitting location of fuel pump control unit -J538-

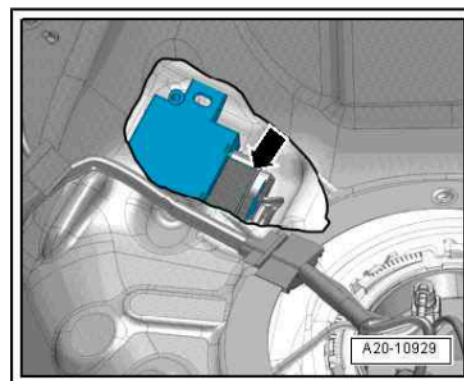
◆ Fuel pump control unit -J538- -arrow- is located between floor panel and fuel tank level with rear seat bench (right-side).



Note

For illustration purposes, the floor panel is cut open in the illustration.

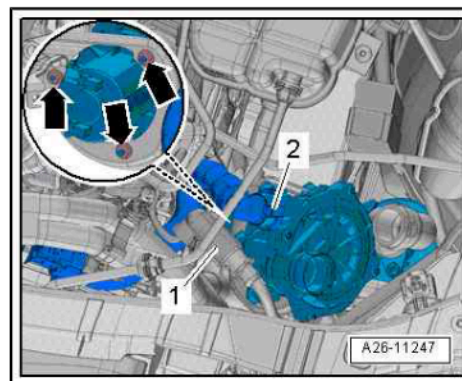
Removing and installing ⇒ fuel supply system; Rep. gr. 20



Fitting location of secondary air pump motor -V101-

- ◆ In engine compartment (front left)

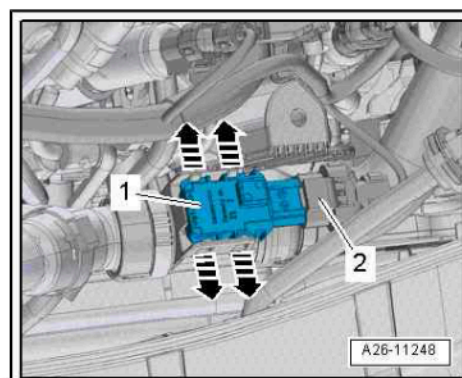
Removing and installing ⇒ Engine, mechanics; Rep. gr. 26



Fitting location of sender 1 for secondary air pressure -G609-

- ◆ In engine compartment (front left) in secondary air pipe

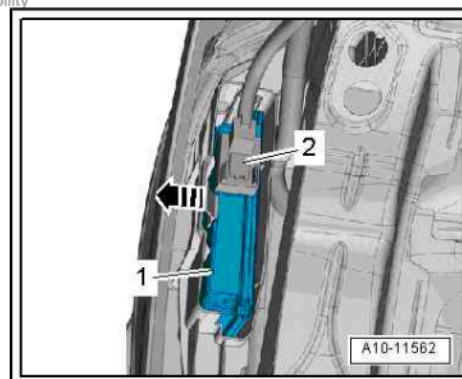
Removing and installing ⇒ Engine, mechanics; Rep. gr. 26



Fitting location of power unit mounting control unit -J931-

- ◆ At rear of wheel housing (front right)

Removing and installing ⇒ Engine, mechanics; Rep. gr. 10



2.2.2 Fitting locations on engine (from above)

1 - Intake manifold pressure sender -G71-

- ☐ Exploded view
⇒ [page 41](#)

2 - Ignition coil 1 with output stage -N70-

- ☐ Exploded view
⇒ [page 72](#)

3 - Ignition coil 2 with output stage -N127-

- ☐ Exploded view
⇒ [page 72](#)

4 - Ignition coil 3 with output stage -N291-

- ☐ Exploded view
⇒ [page 72](#)

5 - Hall sender -G40-

- ☐ Exploded view
⇒ [page 72](#)

6 - Ignition coil 4 with output stage -N292-

- ☐ Exploded view
⇒ [page 72](#)

7 - Activated charcoal filter solenoid valve 1 -N80-

8 - Hall sender 3 -G300-

- ☐ Exploded view
⇒ [page 72](#)

9 - Temperature sender for engine cover panel -G765-

- ☐ Removing and installing
⇒ Engine, mechanics;
Rep. gr. 21

10 - Piston cooling jet control valve -N522-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 17

11 - Stage 3 oil pressure switch -F447-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 17

12 - Ignition coil 8 with output stage -N326-

- ☐ Exploded view ⇒ [page 72](#)

13 - Hall sender 4 -G301-

- ☐ Exploded view ⇒ [page 72](#)

14 - Ignition coil 7 with output stage -N325-

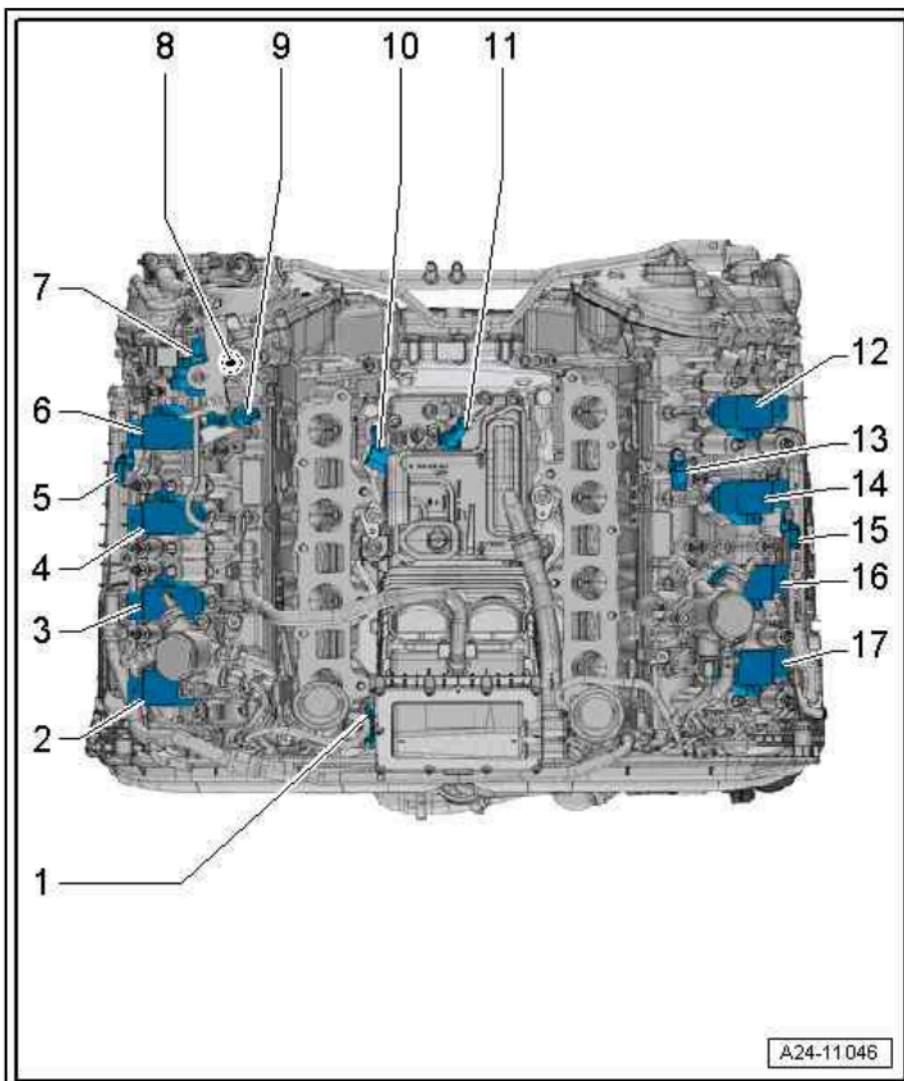
- ☐ Exploded view ⇒ [page 72](#)

15 - Hall sender 2 -G163-

- ☐ Exploded view ⇒ [page 72](#)

16 - Ignition coil 6 with output stage -N324-

- ☐ Exploded view ⇒ [page 72](#)



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17 - Ignition coil 5 with output stage -N323-

- ❑ Exploded view ➔ [page 72](#)

2.2.3 Fitting locations on engine (from front)

1 - Oil temperature sender 2 - G664-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 17

2 - Coolant temperature sender -G62-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 19

3 - Temperature sender for engine temperature regulation - G694-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 19

4 - Coolant valve for cylinder head -N489-

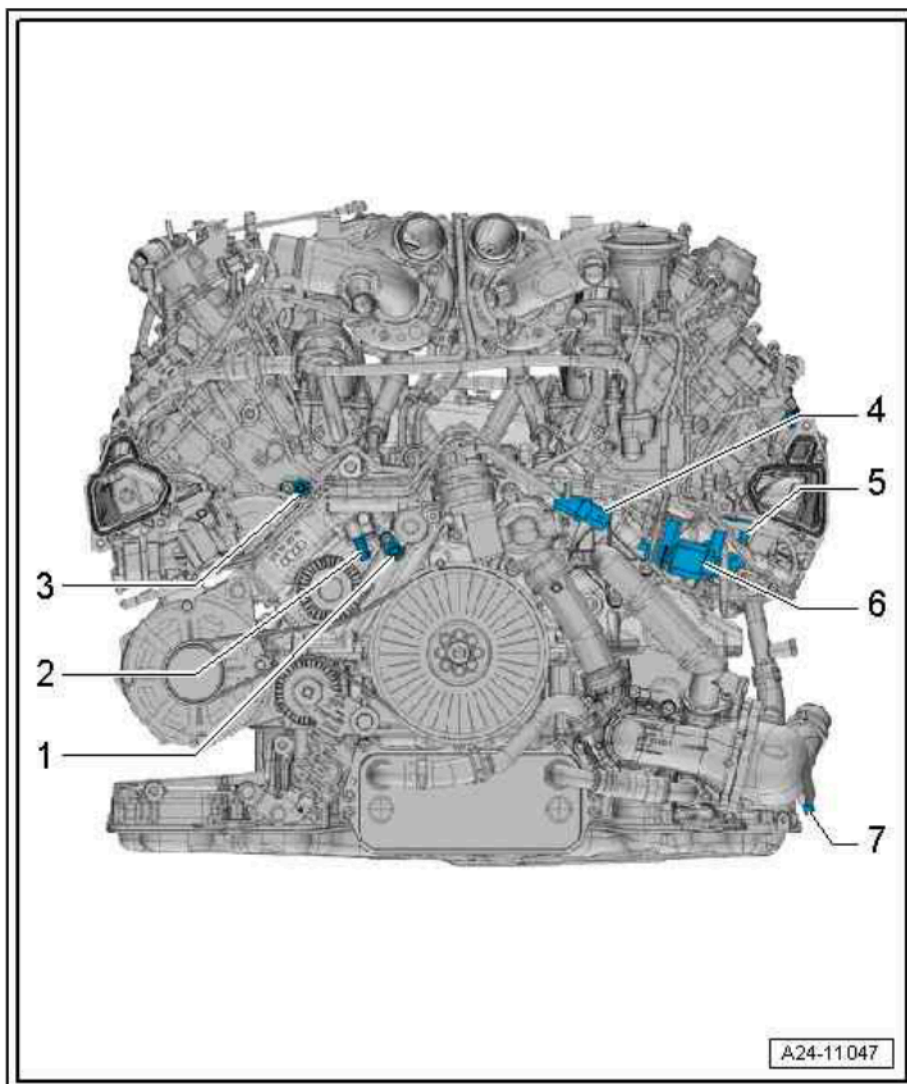
- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 19

5 - Intake manifold flap potentiometer 2 -G512-

- ❑ Exploded view ➔ [page 23](#)

6 - Charge pressure control solenoid valve -N75-

7 - Map-controlled engine cooling system thermostat -F265- Exploded view ➔ Engine, mechanics; Rep. gr. 19



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2.2.4 Fitting locations on engine (from right side)

1 - Engine speed sender -G28-

- ☐ Exploded view
⇒ [page 72](#)

2 - Oil pressure switch for reduced oil pressure -F378-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 17

3 - Oil pressure switch -F22-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 17

4 - Knock sensor 2 -G66-

- ☐ Exploded view
⇒ [page 72](#)

5 - Fuel pressure sender -G247-

- ☐ Exploded view
⇒ [page 23](#)

6 - Intake manifold flap valve -N316-

7 - Intake manifold flap potentiometer -G336-

- ☐ Exploded view
⇒ [page 23](#)

8 - Injector, cylinder 4 -N33-

- ☐ Exploded view
⇒ [page 23](#)

9 - Injector, cylinder 3 -N32-

- ☐ Exploded view
⇒ [page 23](#)

10 - Camshaft control valve 1 -N205-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 15

11 - Exhaust camshaft control valve 1 -N318-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 15

12 - Inlet cam actuator 2 for cylinder 3 -F457-

- ☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 15

13 - Exhaust cam actuator 2 for cylinder 3 -F459-

14 - Inlet cam actuator 1 for cylinder 3 -F456-

15 - Exhaust cam actuator 1 for cylinder 3 -F458-

16 - Exhaust cam actuator 1 for cylinder 2 -F454-

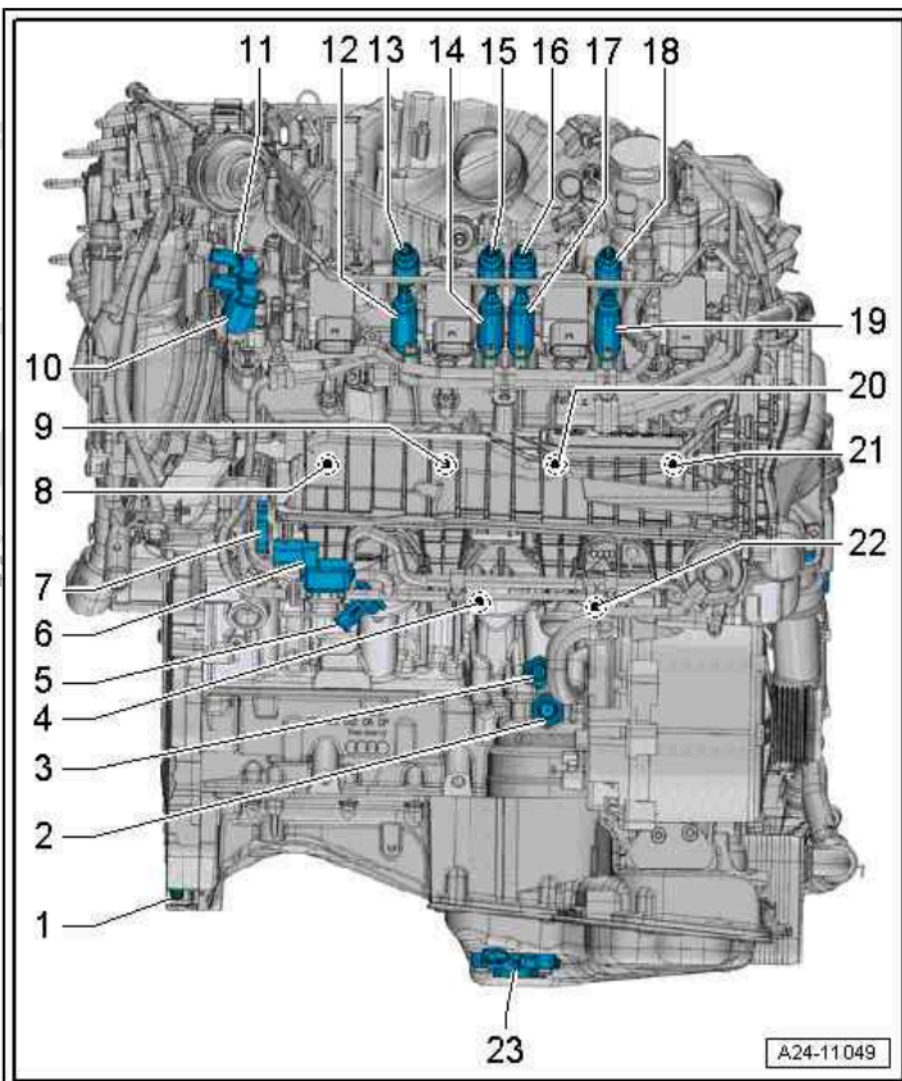
17 - Inlet cam actuator 1 for cylinder 2 -F452-

18 - Exhaust cam actuator 2 for cylinder 2 -F455-

19 - Inlet cam actuator 2 for cylinder 2 -F453-

20 - Injector, cylinder 2 -N31-

- ☐ Exploded view ⇒ [page 23](#)



A24-11 049

21 - Injector, cylinder 1 -N30-

- ❑ Exploded view ➔ [page 23](#)

22 - Knock sensor 1 -G61-

- ❑ Exploded view ➔ [page 72](#)

23 - Oil level and oil temperature sender -G266-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 17

2.2.5 Fitting locations on engine (from left side)

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1 - Valve for oil pressure control -N428-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 17

2 - Secondary air inlet valve - N112-

3 - Knock sensor 3 -G198-

- ❑ Exploded view ➔ [page 72](#)

4 - Secondary air inlet valve 2 -N320-

5 - Injector, cylinder 6 -N84-

- ❑ Exploded view ➔ [page 23](#)

6 - Injector, cylinder 5 -N83-

- ❑ Exploded view ➔ [page 23](#)

7 - Inlet cam actuator 2 for cylinder 5 -F465-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 15

8 - Exhaust cam actuator 2 for cylinder 5 -F467-

9 - Exhaust cam actuator 1 for cylinder 5 -F466-

10 - Inlet cam actuator 1 for cylinder 5 -F464-

11 - Inlet cam actuator 1 for cylinder 8 -F476-

12 - Exhaust cam actuator 1 for cylinder 8 -F478-

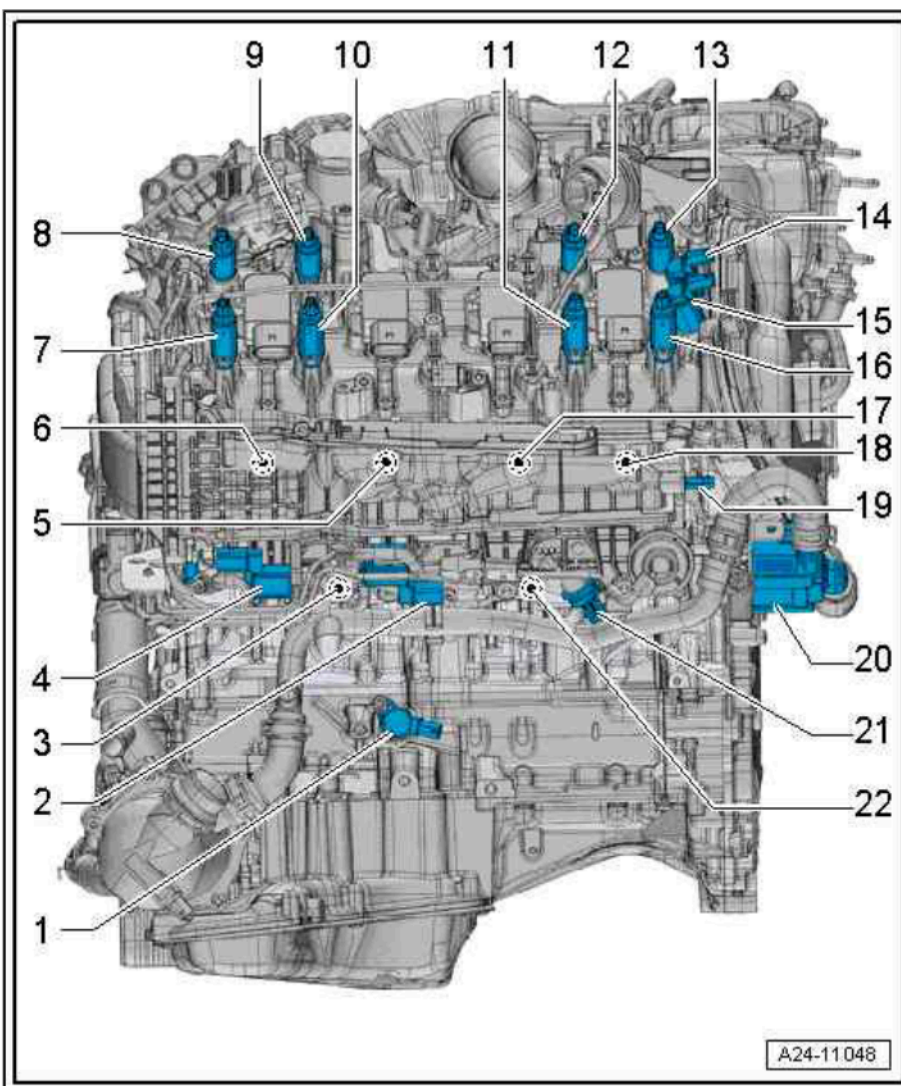
13 - Exhaust cam actuator 2 for cylinder 8 -F479-

14 - Exhaust camshaft control valve 2 -N319-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 15

15 - Camshaft control valve 2 -N208-

- ❑ Exploded view ➔ Engine, mechanics; Rep. gr. 15



16 - Inlet cam actuator 2 for cylinder 8 -F477-

17 - Injector, cylinder 7 -N85-

☐ Exploded view ⇒ [page 23](#)

18 - Injector, cylinder 8 -N86-

☐ Exploded view ⇒ [page 23](#)

19 - Intake air temperature sender -G42-

☐ Exploded view ⇒ [page 23](#)

20 - Coolant circulation pump 2 -V178-

☐ Exploded view ⇒ Engine, mechanics; Rep. gr. 19

21 - Fuel pressure sender 2 -G624-

☐ Exploded view ⇒ [page 23](#)

22 - Knock sensor 4 -G199-

☐ Exploded view ⇒ [page 72](#)

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3 Air cleaner

⇒ "3.1 Exploded view - air cleaner", page 18

⇒ "3.2 Removing and installing air filter element", page 18

⇒ "3.3 Removing and installing air cleaner housing", page 20

3.1 Exploded view - air cleaner

1 - Retainer

- ☐ For air cleaner housing

2 - Rubber buffer

3 - Air cleaner (bottom section)

- ☐ Clean out salt deposits, dirt and leaves, etc.
- ☐ Removing and installing
⇒ "3.3 Removing and installing air cleaner housing", page 20

4 - Air filter element

- ☐ Use genuine air filter element ⇒ Electronic parts catalogue
- ☐ Change intervals ⇒ Maintenance tables
- ☐ Removing and installing
⇒ page 18

5 - Air cleaner (top section)

- ☐ Clean out salt deposits, dirt and leaves, etc.
- ☐ Removing and installing
⇒ page 18

6 - Air ducts

7 - Sealing element

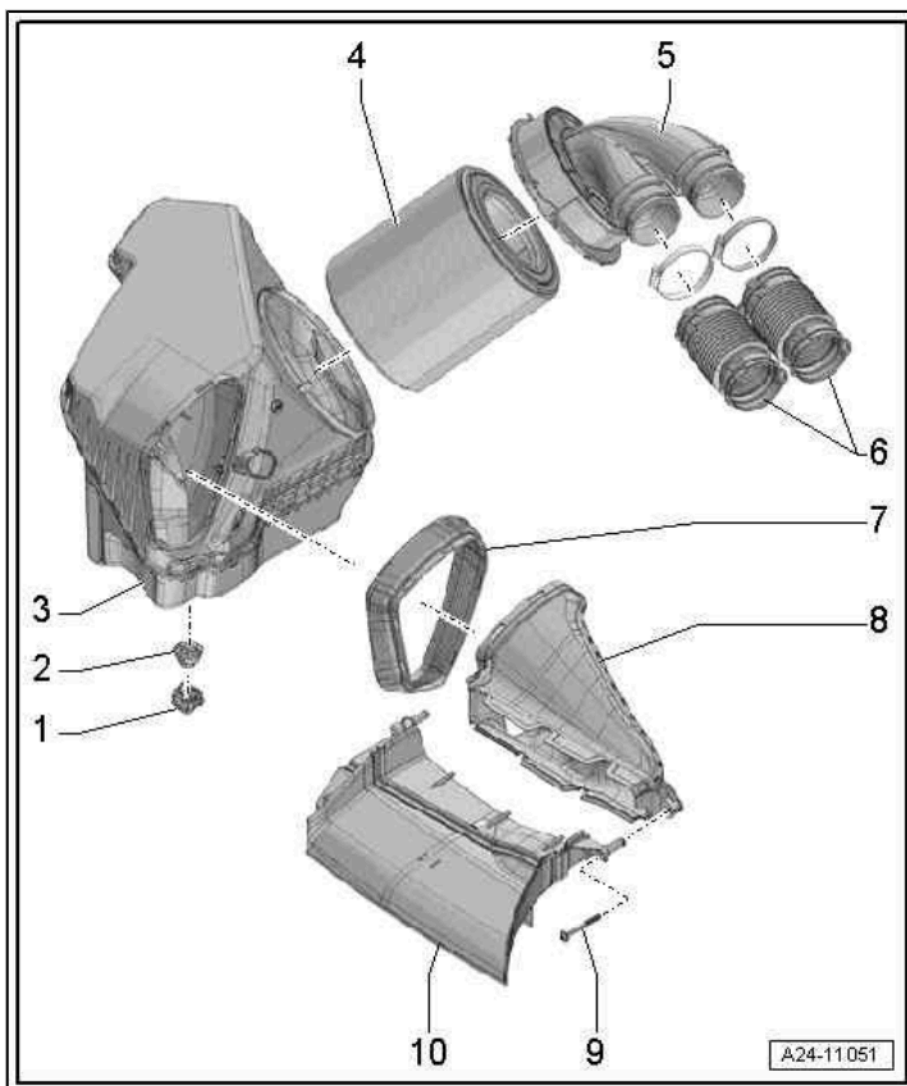
8 - Air duct

- ☐ Clean out salt deposits, dirt and leaves, etc.

9 - Bolt

- ☐ 2.5 Nm

10 - Air duct



3.2 Removing and installing air filter element

Special tools and workshop equipment required

- ◆ Silicone-free lubricant

Removing

- Loosen hose clips -2- and remove air hoses.
- Release catch -3-, turn air cleaner (top section) -1- in anti-clockwise direction -arrow B- and detach.
- Take out air filter element.

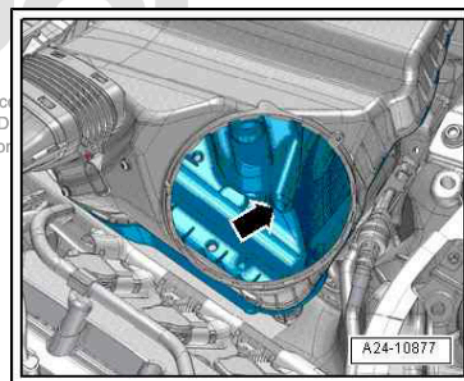
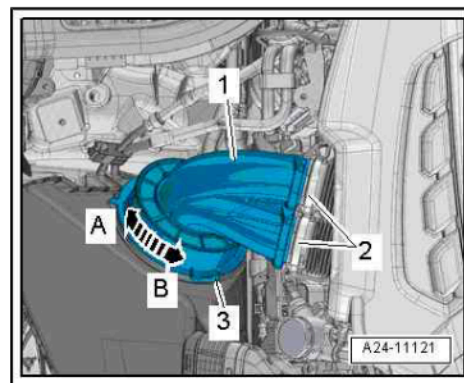
Installing

To ensure that the fuel systems function properly, it is important to observe the following notes and instructions.



Note

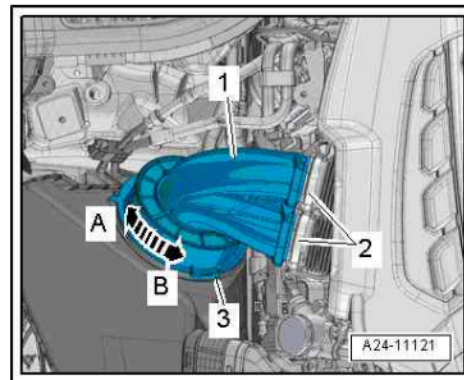
- ◆ *If the air filter element is very dirty or wet, dirt or water could reach components and affect the measured values. This would lead to loss of power, since a smaller injection quantity is calculated.*
- ◆ *Always use genuine part for air filter element.*
- ◆ *The air cleaner housing MUST be clean.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Use a silicone-free lubricant when installing the air hoses.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (such as air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Observe environmental requirements for disposal.*
- Clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections) using a vacuum cleaner.
- Blow out water drain -arrow- with compressed air.
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.



- When installing air filter element, check that it is properly centred in retainer in air cleaner housing.
- Carefully fit air cleaner (top section) onto air cleaner housing without using any force.
- Turn air cleaner (top section) -1- in clockwise direction -arrow A- until catch -3- engages.
- Make sure that air ducts are securely fitted on air cleaner (top section).

Remaining installation steps are carried out in reverse sequence; note the following:

- Install air hoses with screw-type clips -2- ⇒ Engine, mechanics; Rep. gr. 21 .



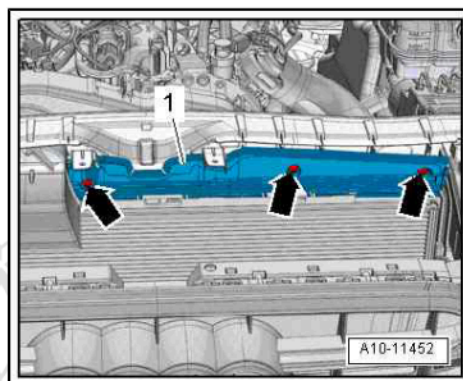
3.3 Removing and installing air cleaner housing

Special tools and workshop equipment required

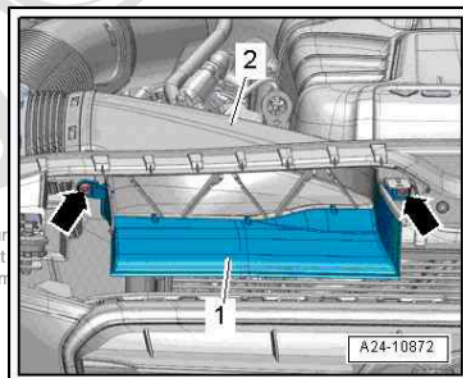
- ◆ Silicone-free lubricant

Removing

- Remove lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 .
- Remove bolts -arrows- and detach air duct -1-.



- Remove bolts -arrows- and detach air duct -2-.



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- Release hose clips -2- and detach air hoses.
- Lift off air cleaner housing -1- with air hoses.

Installing

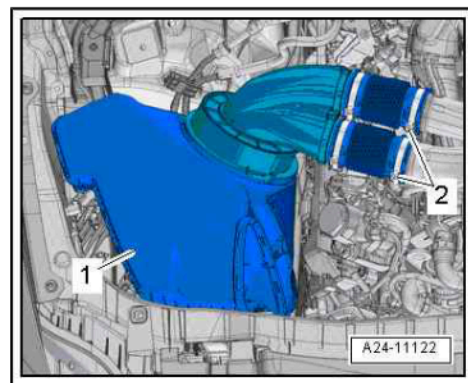


Note

- ◆ *The air cleaner housing MUST be clean.*
- ◆ *To prevent malfunctions, cover critical parts of the engine air intake (such as air pipes, etc.) with a clean cloth when blowing out the air cleaner housing with compressed air.*
- ◆ *Hose connections and air pipes and hoses must be free of oil and grease before assembly.*
- ◆ *Use a silicone-free lubricant when installing the air hoses.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Check for salt residue, dirt and leaves in air pipe (engine intake side).
- Check for dirt and leaves in air duct going from lock carrier to air cleaner housing.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install air ducts with screw-type clips ⇒ Engine, mechanics; Rep. gr. 21 .



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4 Intake manifold, fuel rail and injectors

⇒ "4.1 Exploded view - intake manifold", page 23

⇒ "4.2 Removing and installing intake manifold", page 25

⇒ "4.3 Removing and installing intake manifold flap potentiometer", page 32

⇒ "4.4 Removing and installing injectors", page 34

⇒ "4.5 Removing and installing intake air temperature sender G42", page 37

⇒ "4.6 Removing and installing fuel pressure senders", page 39

⇒ "4.7 Exploded view - throttle valve module", page 41

⇒ "4.8 Removing and installing intake manifold pressure sender G71", page 42

⇒ "4.9 Removing and installing throttle valve module J338", page 43

⇒ "4.10 Removing and installing temperature sender for charge air cooler G763 / G764", page 44

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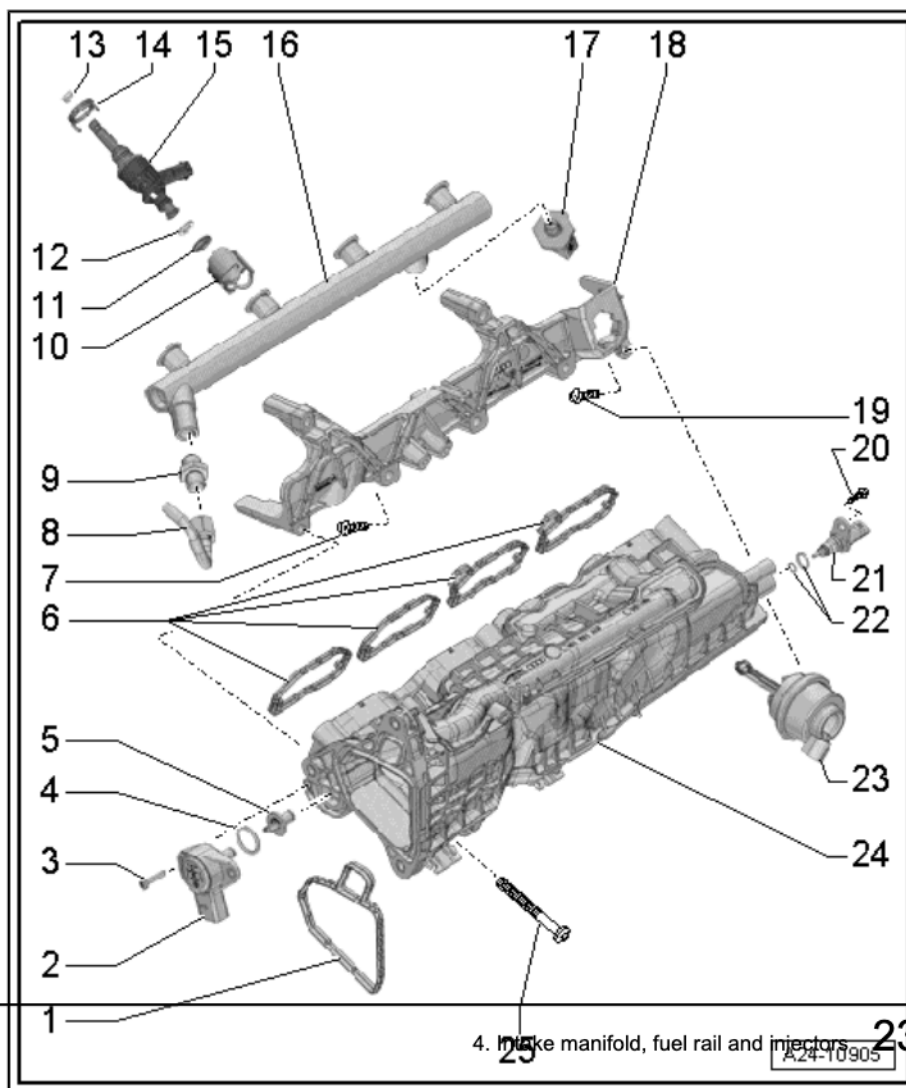
4.1 Exploded view - intake manifold



Note

The illustration shows the intake manifold on the left side of the vehicle.

- 1 - Gasket
 - ☐ Renew
- 2 - Intake manifold flap potentiometer 2 -G512-
 - ☐ Cylinder bank 1 (right-side): intake manifold flap potentiometer - G336-
 - ☐ Removing and installing
⇒ [page 32](#)
- 3 - Bolt
 - ☐ 2.5 Nm
- 4 - Seal
 - ☐ Renew if damaged
 - ☐ When renewing lever out with screwdriver
 - ☐ Press in by hand
- 5 - Coupling
- 6 - Gaskets
 - ☐ For intake manifold
 - ☐ Renew
- 7 - Bolt
 - ☐ 3 Nm
- 8 - Union nut
 - ☐ For high-pressure pipe
 - ☐ To loosen connection





-item 9-, counterhold at fuel rail

- ☐ Observe all instructions for installing high-pressure pipes ⇒ [page 53](#)

- ☐ 25 Nm

9 - Connection

- ☐ 40 Nm

10 - Support ring

- ☐ Make sure it is correctly seated
- ☐ Via this support ring, the fuel rail exerts the force which holds the injector in the cylinder head

11 - O-ring

- ☐ Renew
- ☐ Lubricate lightly with clean engine oil

12 - Spacer ring

- ☐ Renew if damaged

13 - Combustion chamber ring seal

- ☐ Renewing ⇒ ["4.4 Removing and installing injectors", page 34](#)

14 - Sealing element

15 - Injector

Removing and installing ⇒ [page 34](#)

16 - Fuel rail

17 - Fuel pressure sender 2 -G624-

- ☐ ~~Cylinder bank 1 (right-side) fuel pressure sender -G247-~~
- ☐ Removing and installing ⇒ [page 39](#)
- ☐ Lubricate threads lightly with clean engine oil
- ☐ 25 Nm

18 - Retaining clip

- ☐ For fuel rail

19 - Bolt

- ☐ 3 Nm

20 - Bolt

- ☐ 2.5 Nm

21 - Intake air temperature sender -G42-

- ☐ Removing and installing ⇒ [page 37](#)

22 - O-rings

- ☐ Renew

23 - Vacuum unit

- ☐ For actuating intake manifold flaps

24 - Intake manifold

- ☐ Removing and installing ⇒ [page 25](#)

25 - Bolt

- ☐ Tighten in stages and in diagonal sequence
- ☐ 9 Nm

4.2 Removing and installing intake manifold

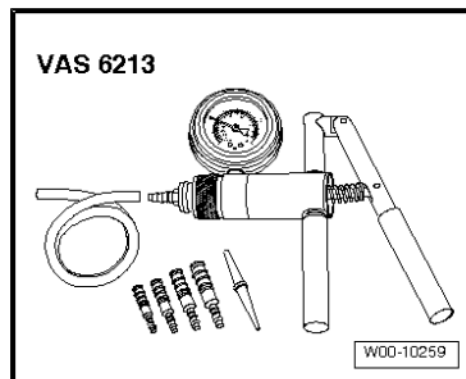
⇒ "4.2.1 Removing and installing intake manifold (right-side) with fuel rail, cylinder bank 1", page 25

⇒ "4.2.2 Removing and installing intake manifold (left-side) with fuel rail, cylinder bank 2", page 28

4.2.1 Removing and installing intake manifold (right-side) with fuel rail, cylinder bank 1

Special tools and workshop equipment required

- ◆ Hand vacuum pump -VAS 6213-



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Removing

- Engine/gearbox assembly removed ⇒ Engine, mechanics;
Rep. gr. 10 .

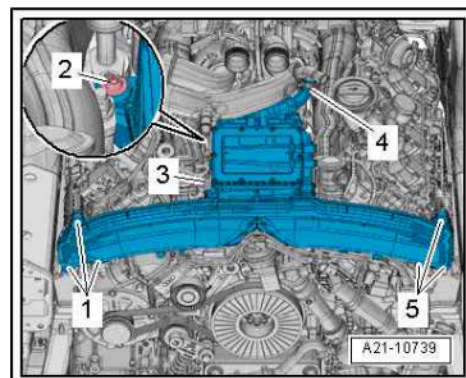


WARNING

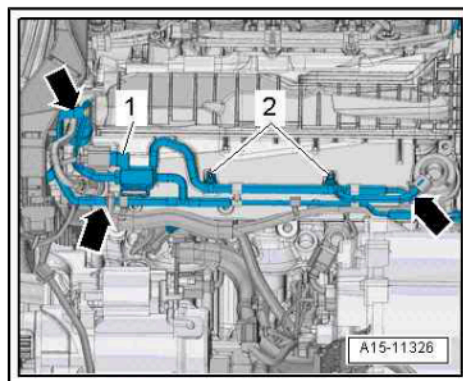
The fuel system operates at extremely high pressure. This can cause injury.

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

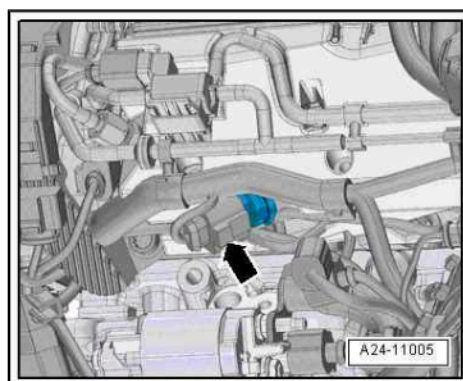
- Reduce fuel pressure in high-pressure section of injection system ⇒ [page 4](#) .
- Remove charge air cooler housing ⇒ Engine, mechanics;
Rep. gr. 21 .



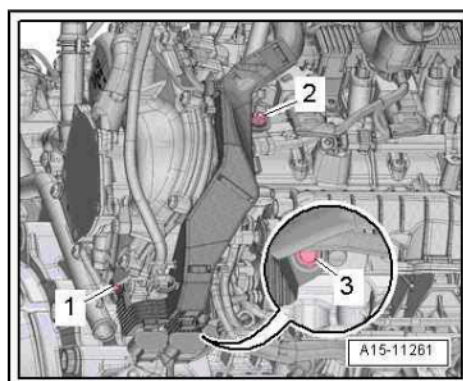
- Disconnect vacuum hoses -arrows-.
- Unplug electrical connector at intake manifold flap valve - N316- -item 1-.
- Take intake manifold flap valve out of bracket and move electrical wiring clear at intake manifold (right-side) -2-.



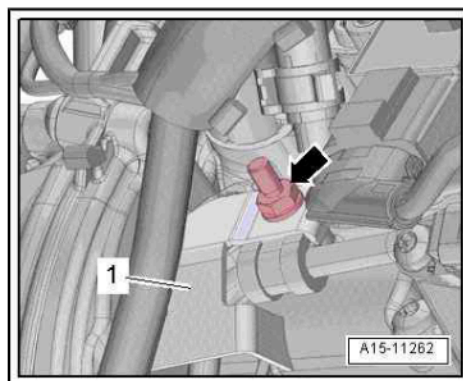
- Unplug electrical connector -arrow- for fuel pressure sender - G247- .



- Remove nuts -1, 2- and bolt -3-, move wiring guide clear and push to one side.



- Unscrew centre hex stud -arrow- and remove guard plate -1-.



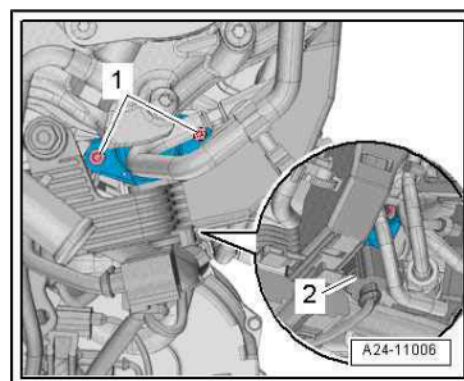
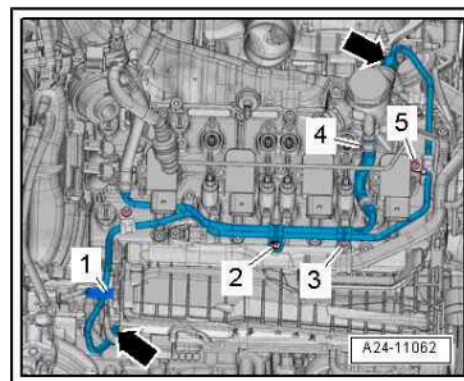
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- Remove nut -3-, move retaining clip clear and remove centre hex stud.
- Remove bolts -2 and 5-.
- Unscrew union nuts -arrows- and push high-pressure pipe to one side.



Do not attempt to bend high-pressure pipe to a different shape.

- Unplug electrical connector -2- for intake manifold flap potentiometer -G336- .



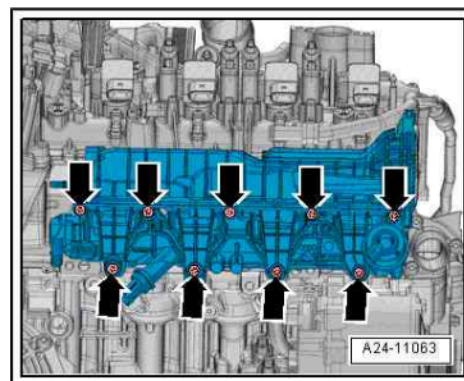
- Detach noise insulation panels.
- Remove bolts -arrows- and detach intake manifold with fuel rail.



Caution

Risk of irreparable damage to engine.

- ◆ *Block off the intake ports with clean cloths to prevent small objects from dropping into the engine through the intake ports in the cylinder heads.*



Installing

- Tightening torques: refer to exploded view of intake manifold ➔ [page 23](#) .



- ◆ *Renew seals and/or gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Parts catalogue.*



Caution

Risk of damage to intake manifold flaps.

- ◆ *To prevent the intake manifold flaps from catching on the guide plates in the cylinder head, the flaps must be in the open position when the intake manifold is installed.*

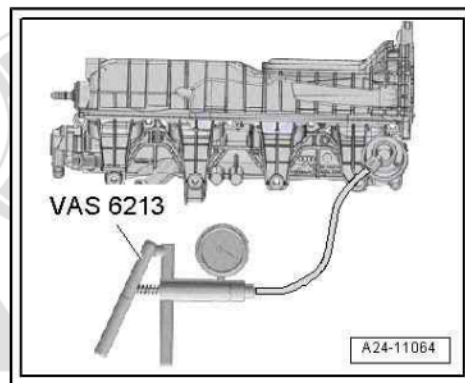
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- Connect hand vacuum pump -VAS 6213- to vacuum unit for actuating intake manifold flaps, as shown in illustration.
- Use vacuum pump to generate a vacuum.
- This will cause the intake manifold flaps to open.
- Press intake manifold with fuel rail evenly onto injectors.
- Tighten bolts for intake manifold in diagonal sequence and in stages.
- Disconnect hand vacuum pump from vacuum unit for actuating intake manifold flaps.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install high-pressure pipe ➔ [page 53](#) .
- Install charge air cooler housing ➔ Engine, mechanics; Rep. gr. 21 .

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WARNING

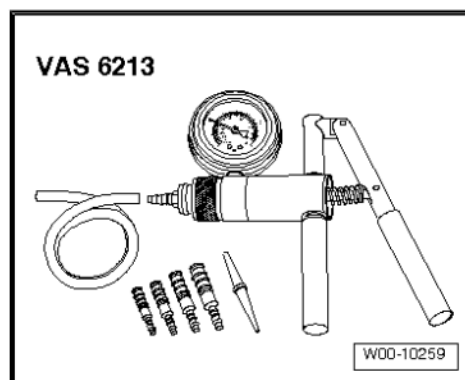
Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

4.2.2 Removing and installing intake manifold (left-side) with fuel rail, cylinder bank 2

Special tools and workshop equipment required

- ◆ Hand vacuum pump -VAS 6213-



Removing

- Engine/gearbox assembly removed ➔ Engine, mechanics; Rep. gr. 10 .



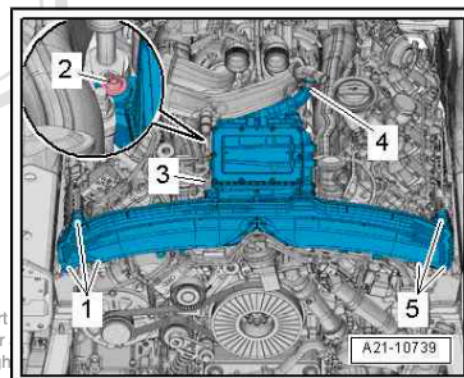
WARNING

The fuel system operates at extremely high pressure. This can cause injury.

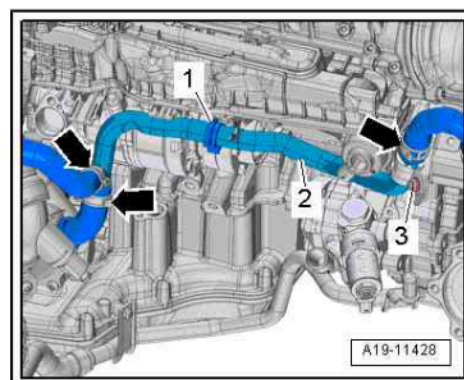
- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

- Reduce fuel pressure in high-pressure section of injection system ➔ [page 4](#) .
- Remove charge air cooler housing ➔ Engine, mechanics; Rep. gr. 21 .

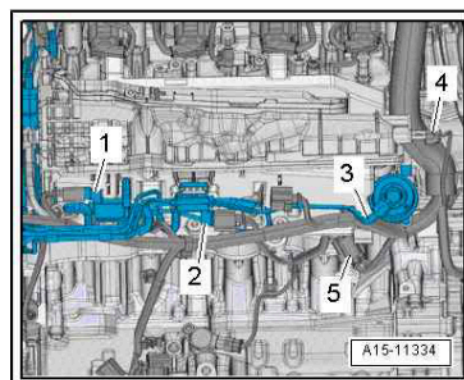
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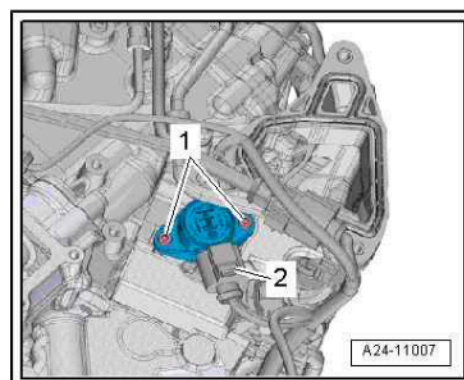
- Remove coolant pipe (top left) ➔ Engine, mechanics; Rep. gr. 19 .



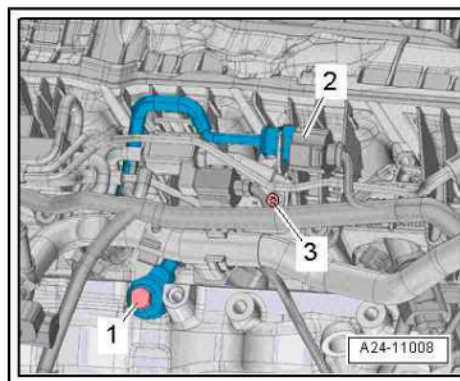
- Disconnect vacuum hose -3- and move clear.
- Detach secondary air inlet valves from bracket and move clear to one side:
 - 1 - Secondary air inlet valve 2 -N320-
 - 2 - Secondary air inlet valve -N112-
- Unplug electrical connectors -4, 5- and move clear wiring harness at intake manifold.



- Unplug electrical connector -2- for intake manifold flap potentiometer 2 -G512- .

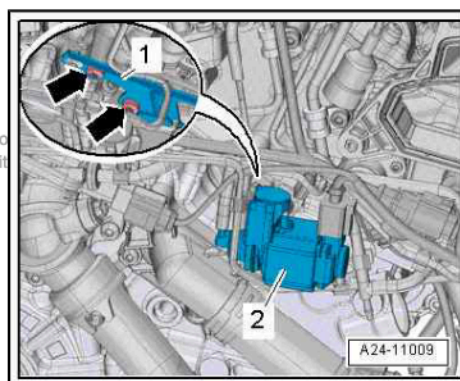


- Remove bolt -3- and move bracket with electrical connector -2- to one side.



- Detach charge pressure control solenoid valve -N75- item 2- from bracket -1- and push it clear to one side.
- Remove bolts -arrows- and push bracket towards front of vehicle.

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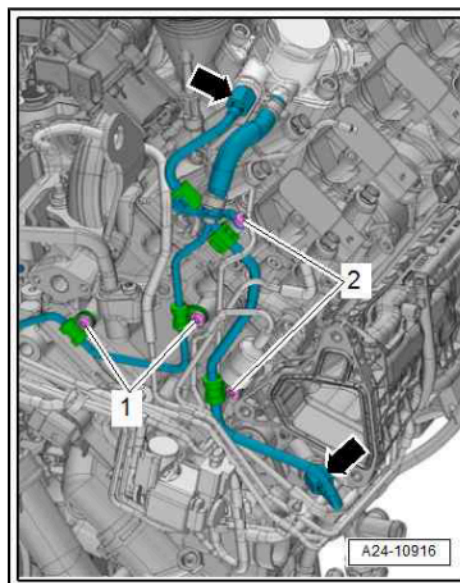


- Remove bolts -2-.
- Unscrew union nuts -arrows- and push high-pressure pipe to one side.



Note

- ◆ Do not attempt to bend high-pressure pipe to a different shape.
- ◆ Disregard -item 1-.



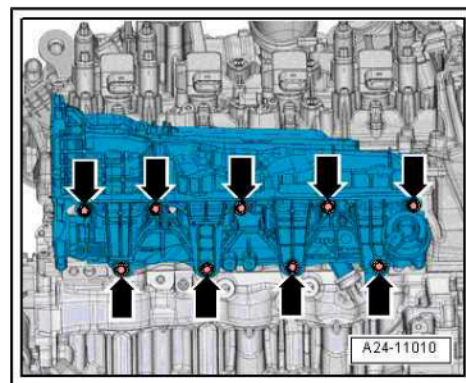
- Detach noise insulation panels.
- Remove bolts -arrows- and detach intake manifold with fuel rail.



Caution

Risk of irreparable damage to engine.

- ◆ *Block off the intake ports with clean cloths to prevent small objects from dropping into the engine through the intake ports in the cylinder heads.*



Installing

- Tightening torques: refer to exploded view of intake manifold
⇒ [page 23](#) .



Note

- ◆ *Renew seals and/or gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue.*



Caution

Risk of damage to intake manifold flaps.

- ◆ *To prevent the intake manifold flaps from catching on the guide plates in the cylinder head, the flaps must be in the open position when the intake manifold is installed.*



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- Connect hand vacuum pump -VAS 6213- to vacuum unit for actuating intake manifold flaps, as shown in illustration.
- Use vacuum pump to generate a vacuum.
- This will cause the intake manifold flaps to open.
- Press intake manifold with fuel rail evenly onto injectors.
- Tighten bolts for intake manifold in diagonal sequence and in stages.
- Disconnect hand vacuum pump from vacuum unit for actuating intake manifold flaps.

Remaining installation steps are carried out in reverse sequence; note the following:

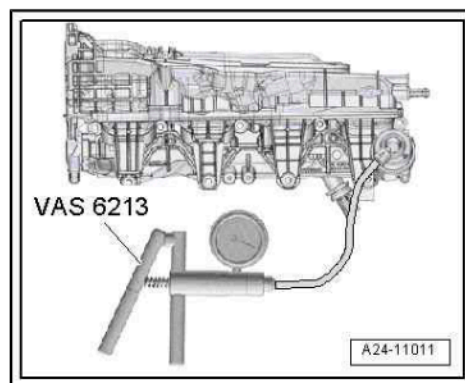
- Install high-pressure pipe ➔ [page 53](#) .
- Install coolant pipe (top left) ➔ Engine, mechanics; Rep. gr. 19 .
- Install charge air cooler housing ➔ Engine, mechanics; Rep. gr. 21 .



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*



4.3 Removing and installing intake manifold flap potentiometer

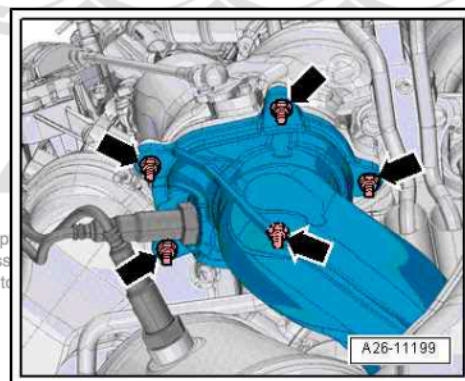
➔ ["4.3.1 Removing and installing intake manifold flap potentiometer G336"](#), [page 32](#)

➔ ["4.3.2 Removing and installing intake manifold flap potentiometer 2 G512"](#), [page 34](#)

4.3.1 Removing and installing intake manifold flap potentiometer -G336-

Removing

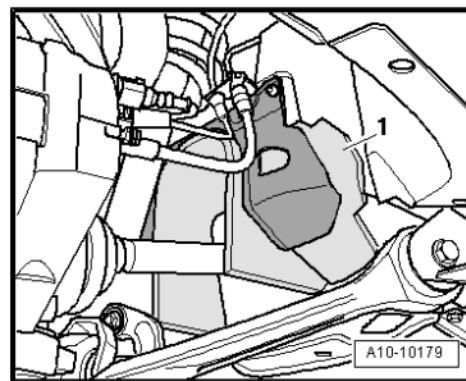
- Remove catalytic converter, cylinder bank 2 (left-side) ➔ Engine, mechanics; Rep. gr. 26 .



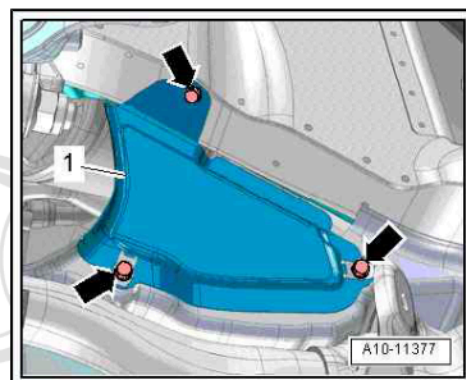
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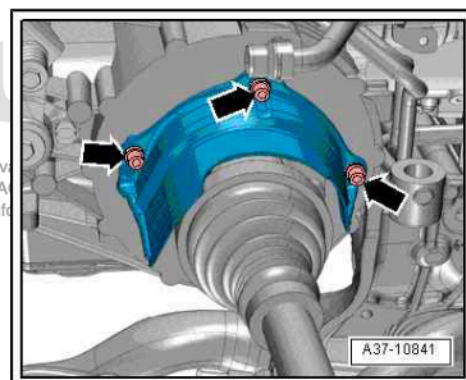
- Remove cover -1- for drive shaft in wheel housing (right-side).



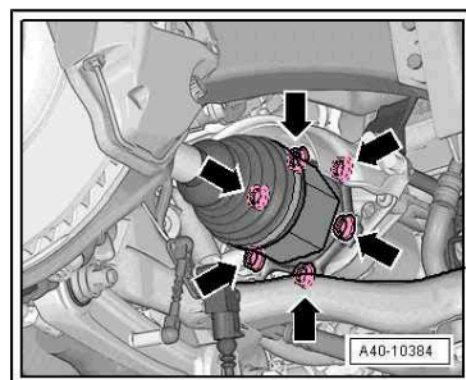
- Remove bolts -arrows- and detach heat shield (right-side) -1-.



- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).



- Detach drive shaft (right-side) from flange shaft of gearbox ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .



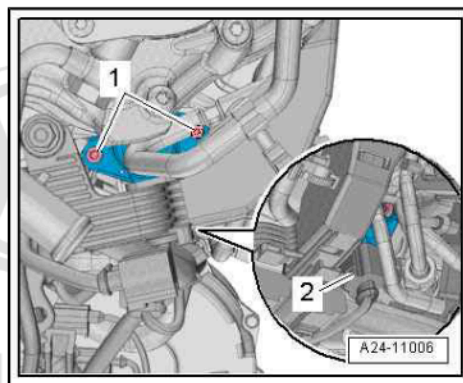
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- Unplug electrical connector -2-.
- Remove bolts -1- and detach intake manifold flap potentiometer -G336- .

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["4.1 Exploded view - intake manifold", page 23](#)
- Secure drive shaft (right-side) to flange shaft of gearbox ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install heat shield for drive shaft (right-side) ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Install catalytic converter, cylinder bank 2 (left-side) ⇒ Engine, mechanics; Rep. gr. 26 .



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4.3.2 Removing and installing intake manifold flap potentiometer 2 -G512-

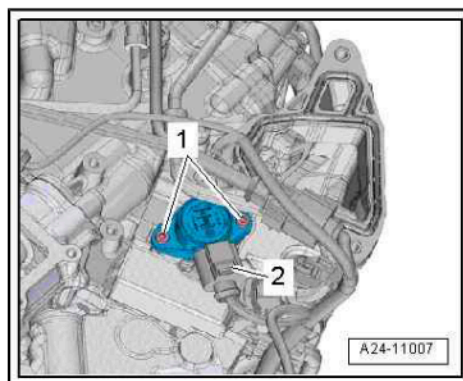
Removing

- Remove high-pressure pipe at cylinder bank 2 (left-side)
⇒ [page 51](#) .
- Remove bolts -arrows- and push bracket to one side.
- Unplug electrical connector -2-.
- Remove bolts -1- and detach intake manifold flap potentiometer 2 -G512- .

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["4.1 Exploded view - intake manifold", page 23](#)
- Install high-pressure pipe ⇒ [page 53](#) .



4.4 Removing and installing injectors

Special tools and workshop equipment required

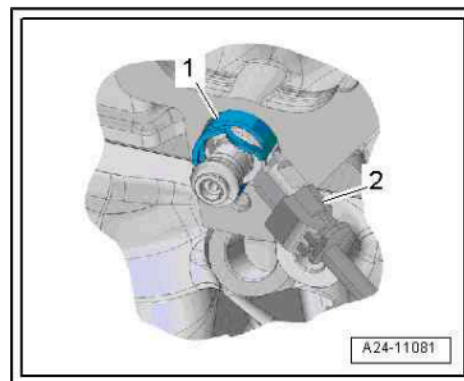
- ◆ Tool set for FSI engines -T10133-



Removing

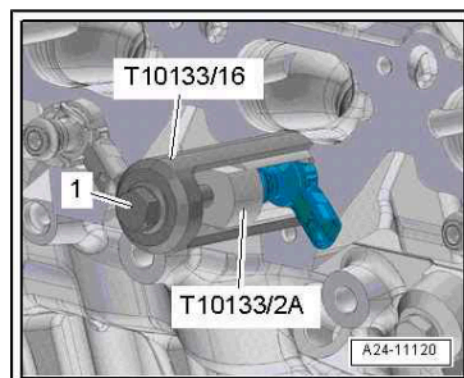
- Engine/gearbox assembly removed ⇒ Engine, mechanics; Rep. gr. 10 .
- Remove intake manifold ⇒ [page 25](#) .

- Unplug relevant electrical connector -2- and remove support ring -1-.



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- Apply puller -T10133/2A- to groove on injector.
- Apply puller -T10133/16A- and pull out injector by turning bolt -1-.



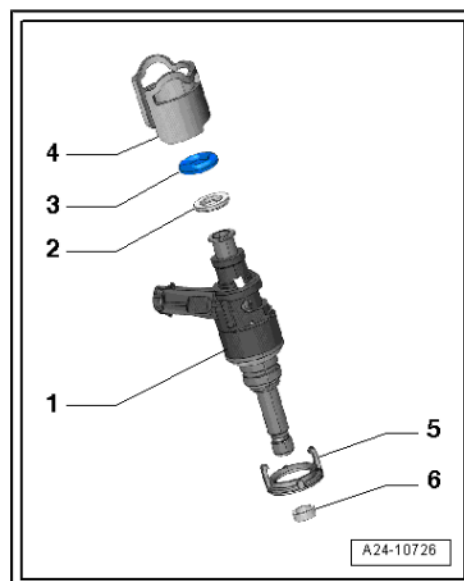
Dismantling injector

- Pull O-ring -3- and spacer ring -2- off injector -1-.
- Unclip sealing element -5-.
- Carefully remove old combustion chamber ring seal -6-. To do so, cut open combustion chamber ring seal using knife or prise open with small screwdriver and then pull off forwards.



Note

Take care not to damage groove on injector. The injector must be renewed if the groove is damaged.

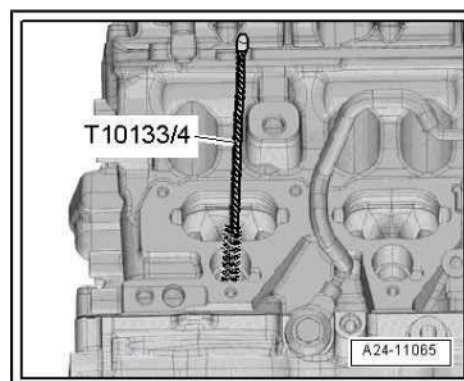


Installing

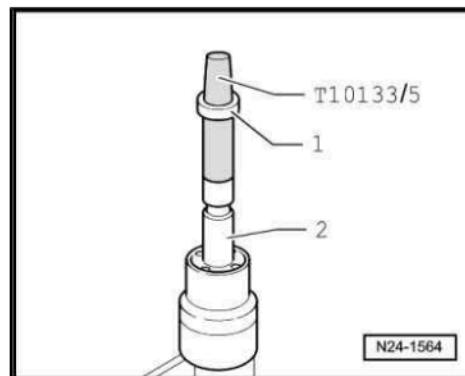


Note

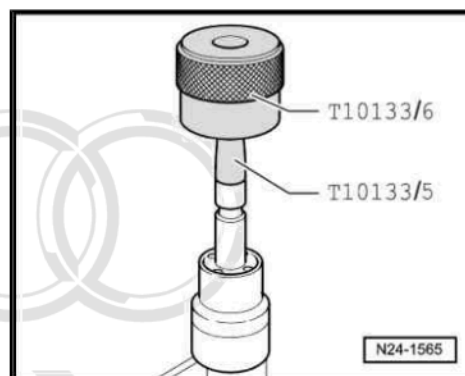
- ◆ Renew sealing element, combustion chamber ring seal and O-ring.
- ◆ Renew spacer ring if damaged.
- ◆ Lubricate O-rings of injectors lightly with clean engine oil.
- Clean bore in cylinder head with nylon cylinder brush -T10133/4-.



- Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- from repair kit onto injector -2-.

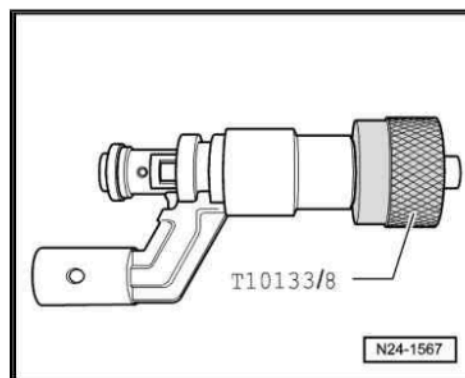
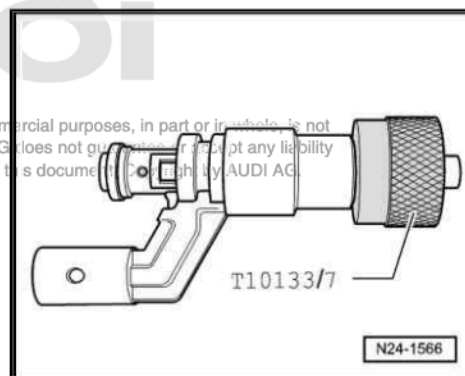


- Using assembly sleeve -T10133/6-, push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go.
- Turn round assembly sleeve -T10133/6- and slide combustion chamber ring seal into groove.


Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

- Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.
- Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
- Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.

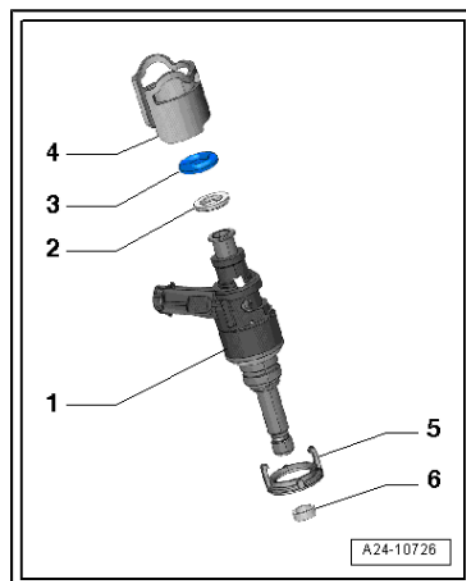


- Fit parts from repair kit onto injector -1-:
- 2 - Spacer ring
- 3 - O-ring
- 4 - Support ring
- 5 - Sealing element
- To make it easier to install injector in fuel rail, lubricate new O-ring lightly with clean engine oil before installing it.



Note

The combustion chamber ring seal -6- must not be lubricated.



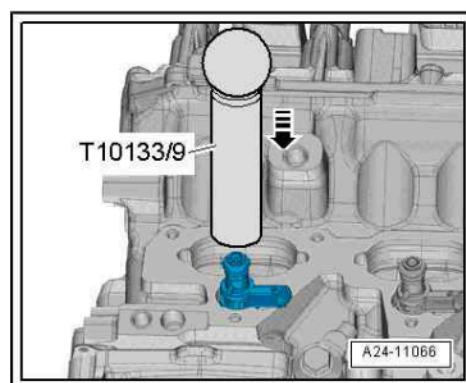
- Use assembly tool -T10133/9- to insert injector as far as it will go into hole in cylinder head; note correct installation position.
- Electrical connector of injector must engage in recess in cylinder head.

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Note

It should be possible to insert the injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.



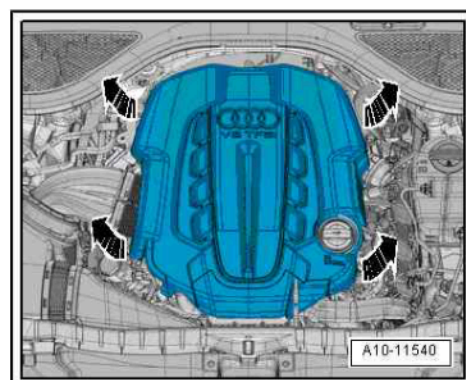
Perform further installation in reverse order, paying attention to the following:

- Install intake manifold ➔ [page 25](#) .

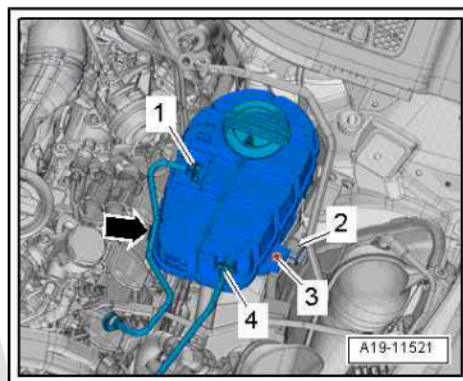
4.5 Removing and installing intake air temperature sender -G42-

Removing

- Remove engine cover panel ➔ Engine, mechanics; Rep. gr. 10 .



- Lift retaining clips -1, 4- and disconnect coolant hoses.
- Move coolant hose clear -arrow-.
- Unplug electrical connector -2-.
- Remove bolt -3-.
- Lift coolant expansion tank out of bracket and push towards front.

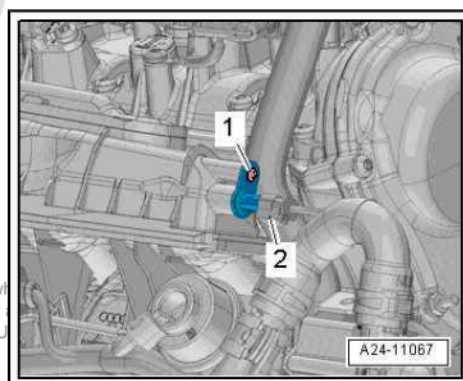


- Remove bolt -1-.
- Pull off intake air temperature sender -G42- and unplug electrical connector -2-.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ "4.1 Exploded view - intake manifold", page 23



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*



Note

- ◆ *Fit new O-ring.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

4.6 Removing and installing fuel pressure senders

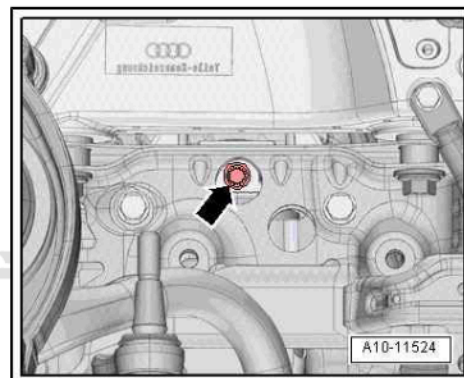
⇒ "4.6.1 Removing and installing fuel pressure sender G247 ",
page 39

⇒ "4.6.2 Removing and installing fuel pressure sender 2 G624 ",
page 40

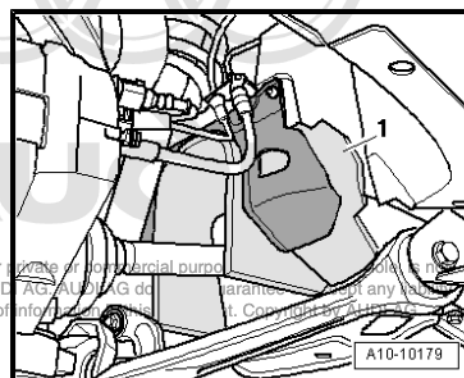
4.6.1 Removing and installing fuel pressure sender -G247-

Removing

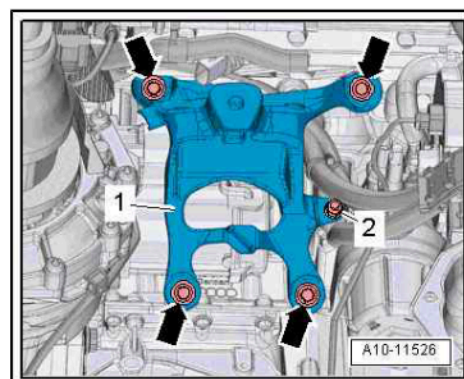
- Remove engine mounting (right-side) ⇒ Engine, mechanics;
Rep. gr. 10 .



- Remove cover -1- for drive shaft in wheel housing (right-side).



- Remove nut -2- and move earth wire clear.
- Remove bolts -arrows- and detach engine support -1- (right-side).

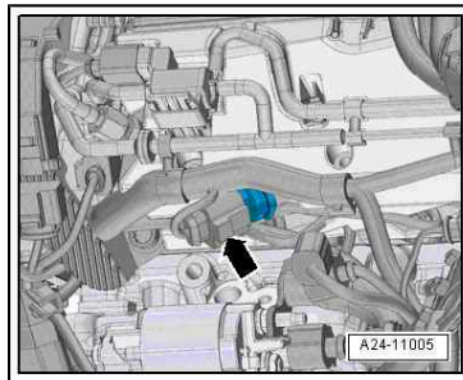


- Unplug electrical connector -arrow-.
- Unscrew fuel pressure sender -G247- .

Installing

Installation is carried out in the reverse order; note the following:

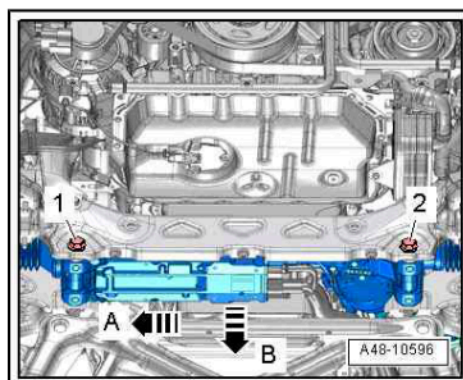
- Tightening torque
⇒ ["4.1 Exploded view - intake manifold", page 23](#)
- Install engine support and engine mounting (right-side) ⇒ Engine, mechanics; Rep. gr. 10 .



4.6.2 Removing and installing fuel pressure sender 2 -G624-

Removing

- Remove electromechanical steering rack ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 48 .

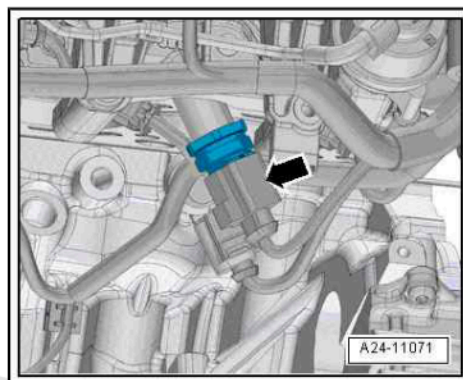


- Unplug electrical connector -arrow-.
- Unscrew fuel pressure sender 2 -G624- .

Installing

Installation is carried out in the reverse order; note the following:

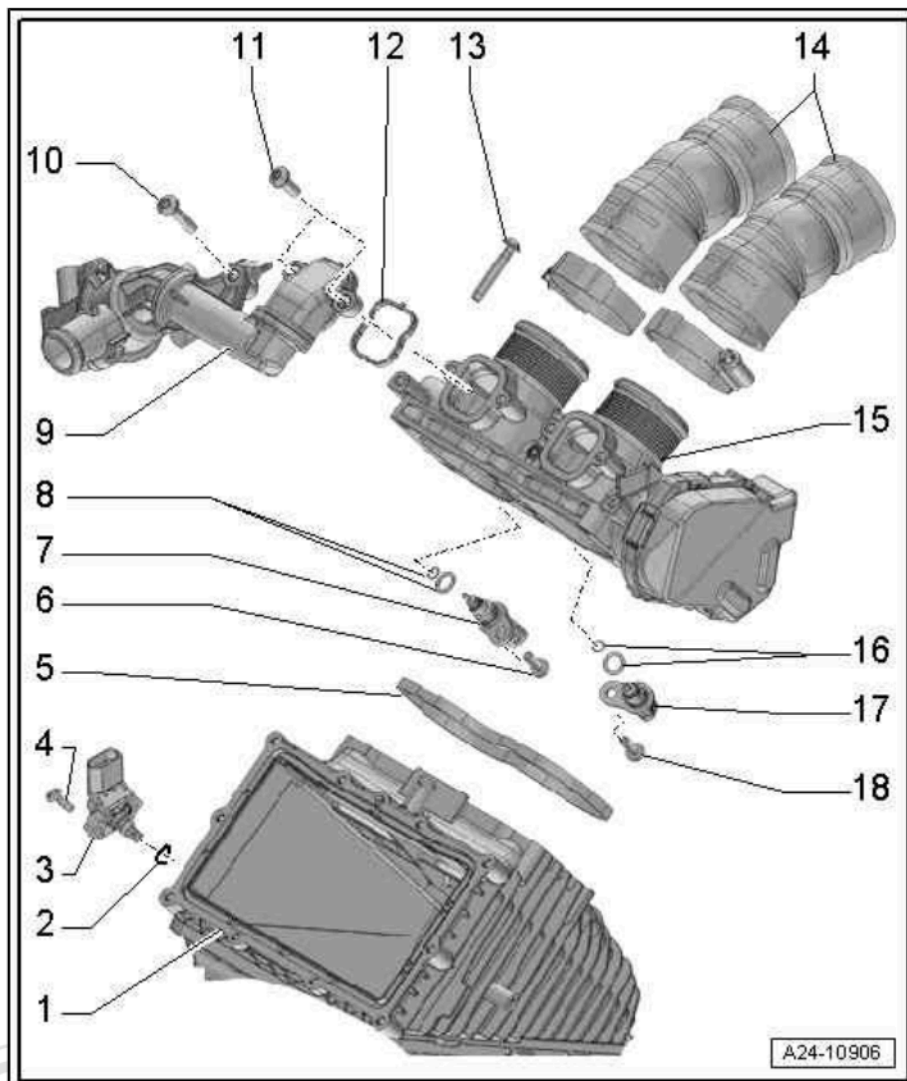
- Tightening torque
⇒ ["4.1 Exploded view - intake manifold", page 23](#)
- Install electromechanical steering rack ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 48 .



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4.7 Exploded view - throttle valve module

- 1 - Charge air cooler housing
 - ☐ With air ducts
 - ☐ Removing and installing
⇒ Engine, mechanics;
Rep. gr. 21
- 2 - O-ring
 - ☐ Renew
- 3 - Intake manifold pressure sender -G71-
 - ☐ Removing and installing
⇒ [page 42](#)
- 4 - Bolt
 - ☐ 3 Nm
- 5 - Gasket
 - ☐ For throttle valve module -J338-
 - ☐ Renew
- 6 - Bolt
 - ☐ 9 Nm
- 7 - Temperature sender 1 for charge air cooler -G763-
 - ☐ Removing and installing
⇒ [page 44](#)
- 8 - O-rings
 - ☐ Renew
- 9 - Air duct
 - ☐ With turbocharger air recirculation valve -N249-
- 10 - Bolt
 - ☐ 9 Nm
- 11 - Bolt
 - ☐ 9 Nm
- 12 - Gasket
 - ☐ Renew
- 13 - Bolt
 - ☐ 5 Nm
- 14 - Air hoses
 - ☐ To turbochargers
- 15 - Throttle valve module -J338-
 - ☐ Removing and installing ⇒ [page 43](#)
- 16 - O-rings
 - ☐ Renew
- 17 - Temperature sender 2 for charge air cooler -G764-
 - ☐ Removing and installing ⇒ [page 44](#)



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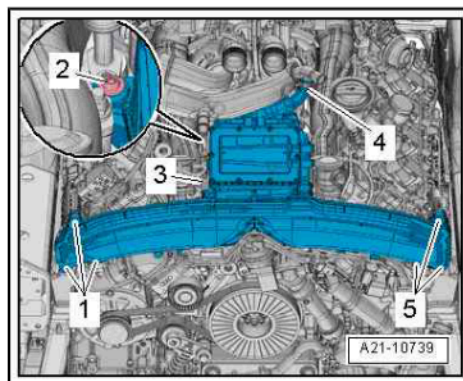
18 - Bolt

□ 9 Nm

4.8 Removing and installing intake manifold pressure sender -G71-

Removing

- Remove charge air cooler housing ⇒ Engine, mechanics; Rep. gr. 21 .



- Unscrew bolts -arrows- and pull intake manifold pressure sender -G71- -item 1- out of air pipe.

Installing

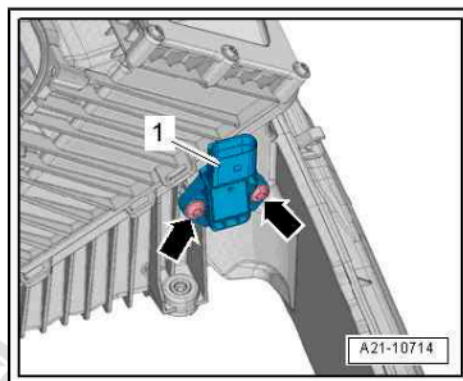
Installation is carried out in the reverse order; note the following:

- Tightening torque
⇒ ["4.7 Exploded view - throttle valve module", page 41](#)



Note

Fit new O-ring.



- Install charge air cooler housing ⇒ Engine, mechanics; Rep. gr. 21 .



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

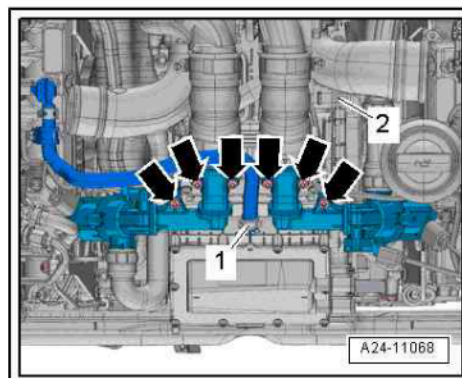
- ♦ *The engine cover panel must always be fitted before the bonnet is closed.*
- ♦ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

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4.9 Removing and installing throttle valve module -J338-

Removing

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .
- Release hose clip -1- and detach air hose.
- Unplug electrical connector -2- and move wiring clear.
- Remove bolts -arrows- and move turbocharger air recirculation valve -N249- and turbocharger air recirculation valve, cylinder bank 2 -N427- clear to one side.



- Unscrew bolts -arrows- and release hose clips -1-.
- Detach throttle valve module -J338- and unplug electrical connectors -2-.

Installing

Installation is carried out in the reverse order; note the following:

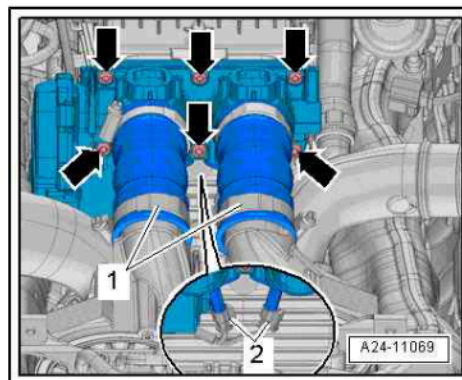
- Tightening torques
⇒ ["4.7 Exploded view - throttle valve module", page 41](#)

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Note

- ◆ *Renew gasket.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- Install air ducts with screw-type clips ⇒ Engine, mechanics; Rep. gr. 21 .
- After renewing throttle valve module, perform "Adaption" in "Guided Functions" mode of vehicle diagnostic tester .



4.10 Removing and installing temperature sender for charge air cooler -G763- / -G764-

Removing

- Remove throttle valve module -J338- ➔ [page 43](#) .
- Unscrew relevant bolt -2- and detach temperature sender:

1 - Temperature sender 2 for charge air cooler -G764-

3 - Temperature sender 1 for charge air cooler -G763-

Installing

Installation is carried out in the reverse order; note the following:

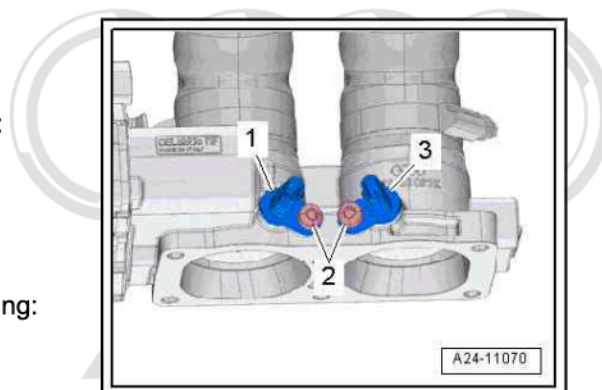
- Tightening torques
➔ ["4.7 Exploded view - throttle valve module", page 41](#)



Note

Fit new O-rings.

- Install throttle valve module -J338- ➔ [page 43](#) .



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5 High-pressure pump

⇒ "5.1 Exploded view - high-pressure pump", page 45

⇒ "5.2 Exploded view - fuel lines", page 46

⇒ "5.3 Removing and installing high-pressure pipe", page 49

⇒ "5.4 Removing and installing fuel pressure sender for low pressure G410", page 54

⇒ "5.5 Removing and installing high-pressure pump", page 55

5.1 Exploded view - high-pressure pump

1 - Hose clip

2 - Fuel hose (low-pressure section)

3 - Union nut

- ☐ For high-pressure pipe
- ☐ Counterhold connection on high-pressure pump to loosen
- ☐ Observe all instructions for installing high-pressure pipes ⇒ [page 53](#)
- ☐ 25 Nm

4 - High-pressure pump

- ☐ Do not hold onto or pull on plunger of high-pressure pump
- ☐ Cylinder bank 1 (right-side) with fuel metering valve -N290-
- ☐ Cylinder bank 2 (left-side) with fuel metering valve 2 -N402-
- ☐ Removing and installing ⇒ [page 55](#)

5 - Bolt

- ☐ Renew
- ☐ 20 Nm + +45°

6 - Fuel pressure sender for low pressure -G410-

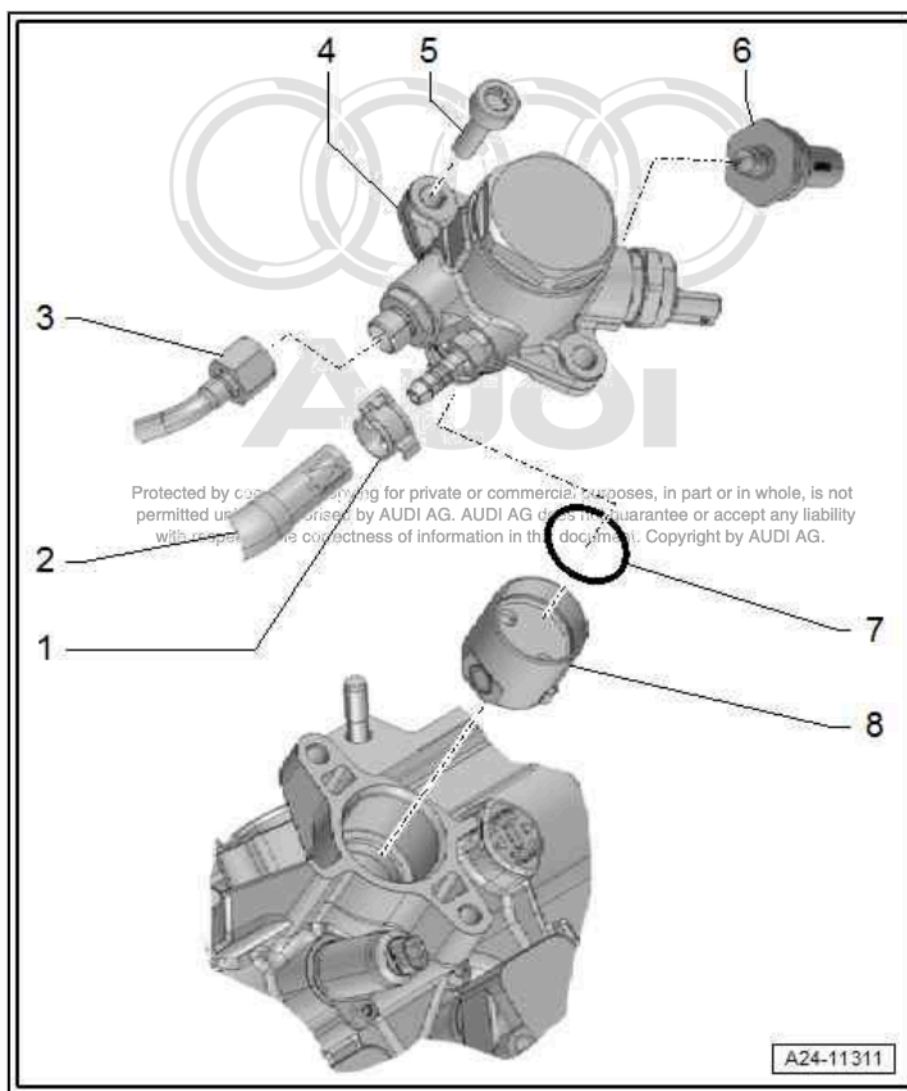
- ☐ Removing and installing ⇒ [page 54](#)
- ☐ 15 Nm

7 - O-ring

- ☐ Renew
- ☐ Lubricate lightly with clean engine oil before installing

8 - Roller tappet

- ☐ Can only be installed in one position
- ☐ Lubricate lightly with clean engine oil before installing



5.2 Exploded view - fuel lines

⇒ "5.2.1 Exploded view - fuel lines, cylinder bank 1 (right-side)",
page 46

⇒ "5.2.2 Exploded view - fuel lines, cylinder bank 2 (left-side)",
page 47

5.2.1 Exploded view - fuel lines, cylinder bank 1 (right-side)

1 - Centre hex stud

□ 9 Nm

2 - Bolt

□ 9 Nm

3 - High-pressure pipe



WARNING

The fuel system operates at extremely high pressure. This can cause injury. The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.

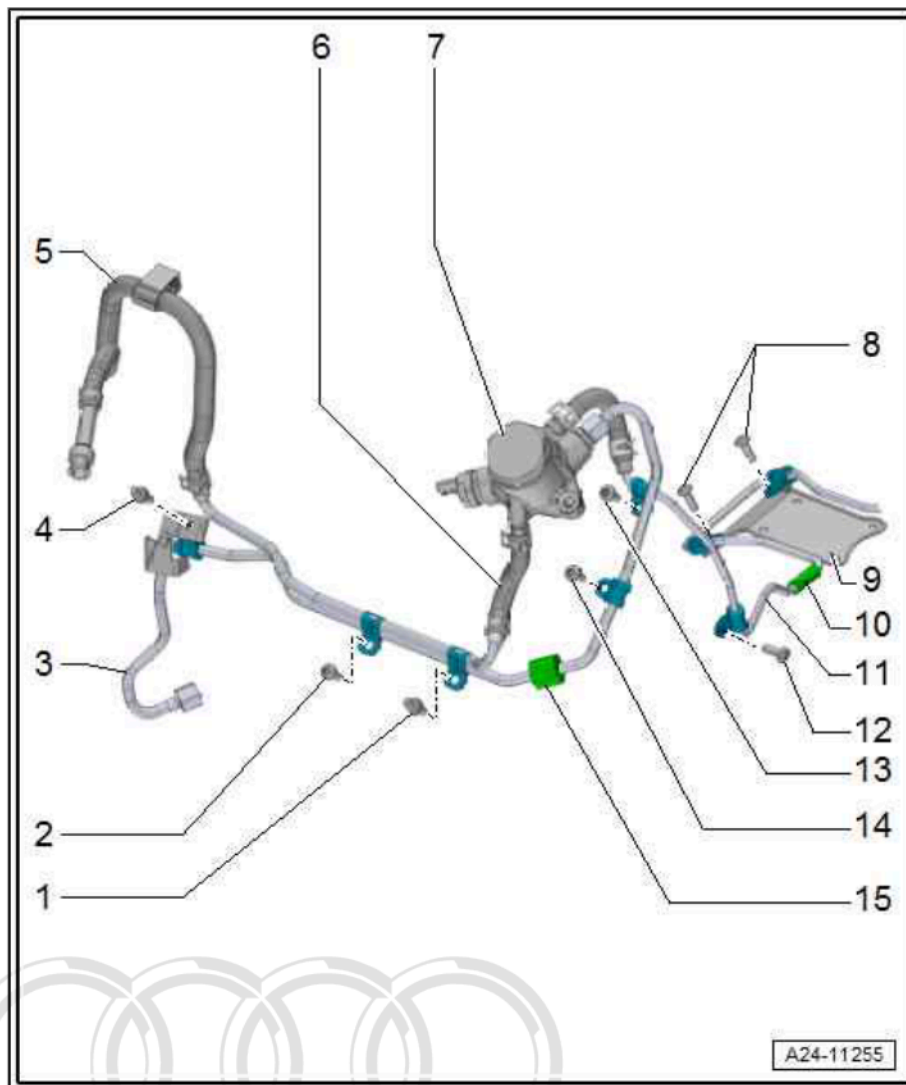
□ Reducing fuel pressure in high-pressure section of injection system
⇒ page 4

□ Removing and installing
⇒ page 58

□ Counterhold at connection on high-pressure pump/fuel rail when loosening union nuts

□ Observe all instructions for installing high-pressure pipes ⇒ page 53

□ Tightening torque for union nuts
⇒ Item 8 (page 23) ,
⇒ Item 3 (page 45)



4 - Centre hex stud

□ 9 Nm

5 - Fuel supply hose

6 - Fuel hose (low-pressure section)

7 - High-pressure pump

8 - Bolts

□ For retaining clips

□ 9 Nm

9 - Bracket

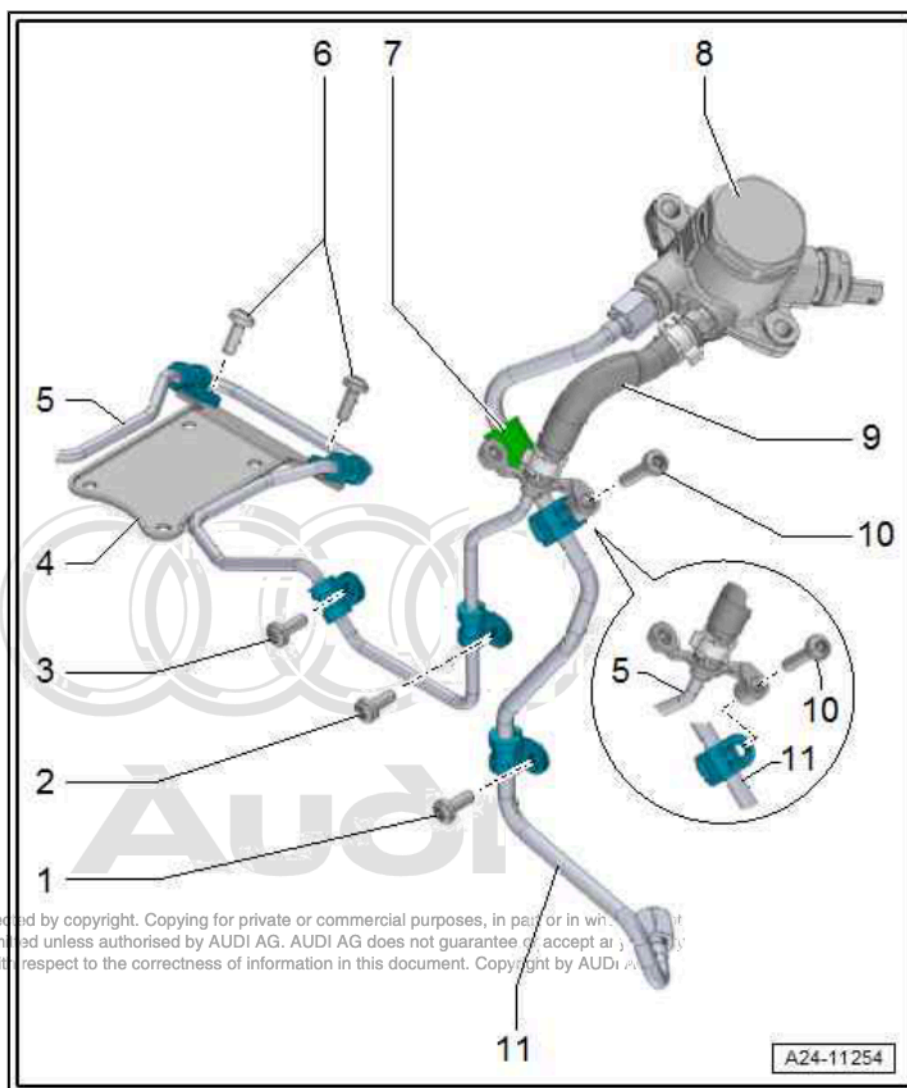
□ For low-pressure line

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- 10 - Rubber damper
 - ☐ Must make contact with cylinder block
- 11 - Low-pressure line
 - ☐ Note minimum clearance from bracket for low-pressure line ⇒ [page 49](#)
- 12 - Bolt
 - ☐ For retaining clip
 - ☐ 9 Nm
- 13 - Bolt
 - ☐ For retaining clip
 - ☐ 9 Nm
- 14 - Bolt
 - ☐ For retaining clip
 - ☐ 9 Nm
- 15 - Rubber damper
 - ☐ Must make contact with cylinder head cover

5.2.2 Exploded view - fuel lines, cylinder bank 2 (left-side)

- 1 - Bolt
 - ☐ For retaining clip
 - ☐ 9 Nm
- 2 - Bolt
 - ☐ For retaining clip
 - ☐ 9 Nm
- 3 - Bolt
 - ☐ For retaining clip
 - ☐ 9 Nm
- 4 - Bracket
 - ☐ For low-pressure line
- 5 - Low-pressure line
 - ☐ Note minimum clearance from bracket for low-pressure line
⇒ [page 49](#)
- 6 - Bolts
 - ☐ For retaining clips
 - ☐ 9 Nm
- 7 - Rubber damper
 - ☐ Must make contact with bracket for adjacent low-pressure line
- 8 - High-pressure pump
- 9 - Fuel hose (low-pressure section)
 - ☐ Note installation position ⇒ [page 48](#)
- 10 - Bolt
 - ☐ 9 Nm



11 - High-pressure pipe



WARNING

The fuel system operates at extremely high pressure. This can cause injury.

The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.

- ☐ Reducing fuel pressure in high-pressure section of injection system ➔ [page 4](#)
- ☐ Removing and installing ➔ [page 58](#)
- ☐ Counterhold at connection on high-pressure pump/fuel rail when loosening union nuts
- ☐ Observe all instructions for installing high-pressure pipes ➔ [page 53](#)
- ☐ Tightening torque for union nuts ➔ [Item 8 \(page 23\)](#) , ➔ [Item 3 \(page 45\)](#)

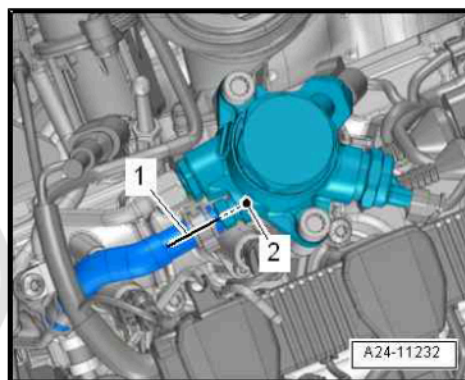
Installation position of fuel hose (low-pressure section)

- Marking -1- on fuel hose (low-pressure section) must be aligned with marking -2- on high-pressure pump.



Note

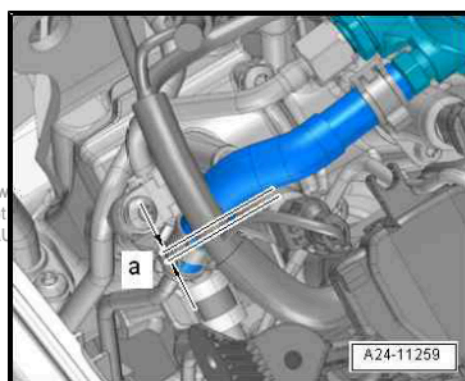
Illustration shows the installation position for cylinder bank 2 (left-side).



Minimum clearance between fuel hose (low-pressure section) and exhaust cam actuator 2 for cylinder 5 -F467-

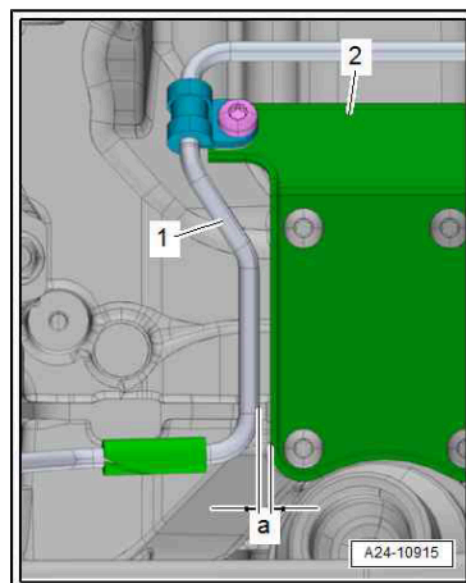
- Minimum clearance -a- = 2 mm must be maintained between fuel hose (low-pressure section) and exhaust cam actuator 2 for cylinder 5 -F467- .

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Minimum clearance between low-pressure line and bracket for low-pressure line

- Minimum clearance -a- = 2 mm must be maintained between low-pressure line -1- and bracket -2- for low-pressure line.



5.3 Removing and installing high-pressure pipe

⇒ ["5.3.1 Removing high-pressure pipe \(cylinder bank 1, right-side\)", page 49](#)

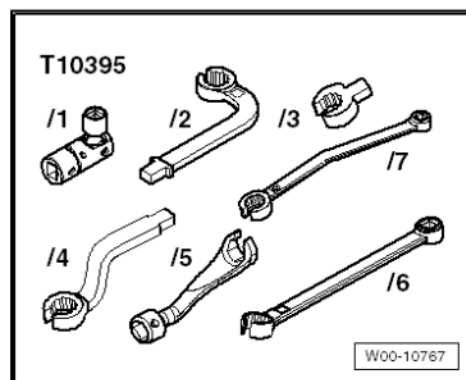
⇒ ["5.3.2 Removing high-pressure pipe \(cylinder bank 2, left-side\)", page 51](#)

⇒ ["5.3.3 Installing high-pressure pipe", page 53](#)

5.3.1 Removing high-pressure pipe (cylinder bank 1, right-side)

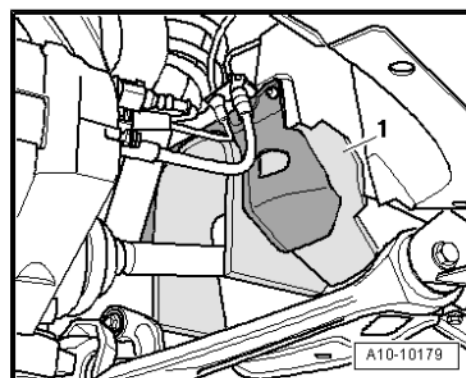
Special tools and workshop equipment required

- ◆ Tool set, 17 mm -T10395-

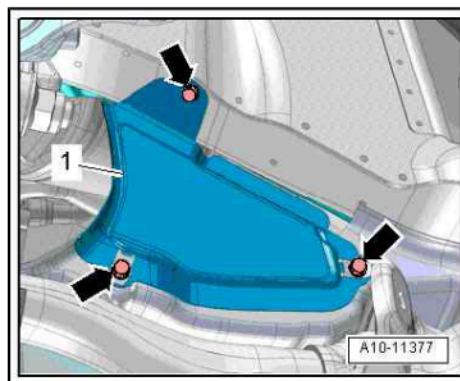


Removing

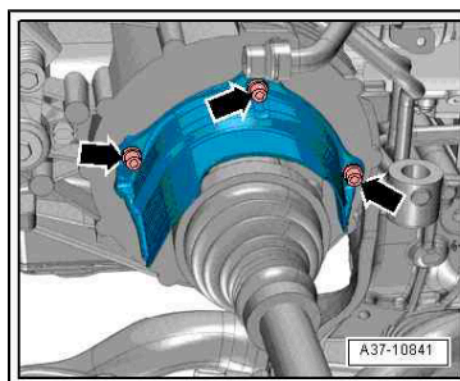
- Remove air cleaner housing ⇒ [page 20](#) .
- Remove cover -1- for drive shaft in wheel housing (right-side).



- Remove bolts -arrows- and detach heat shield (right-side) -1-.

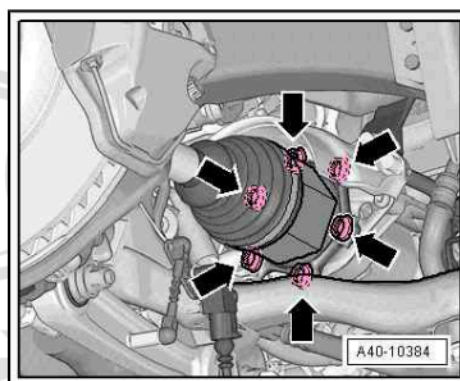


- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).

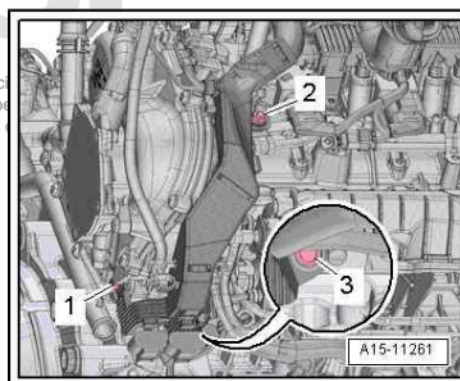


- Detach drive shaft (right-side) from flange shaft of gearbox ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .

- Remove ignition coil "cylinder 4" ⇒ [page 73](#) .

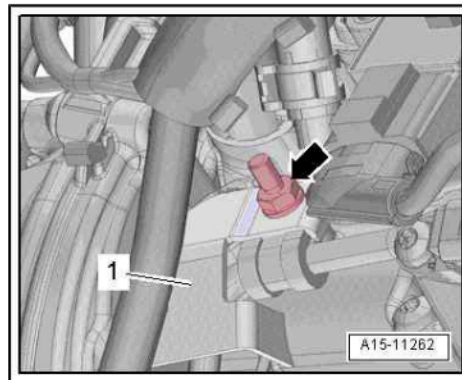


- Remove nuts -1, 2- and bolt -3-, move wiring guide clear and push to one side.



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- Unscrew centre hex stud -arrow- and remove guard plate -1-.



Caution

Protect fuel system against contamination.

- ◆ *Observe rules for cleanliness and follow instructions for working on fuel system ➔ [page 4](#).*

- Disconnect fuel line -2- by pressing release ring.



Note

Disregard -item 1-.

- Disconnect vacuum hose -1-.

- Remove nut -3- move retaining clip clear and remove centre hex stud.

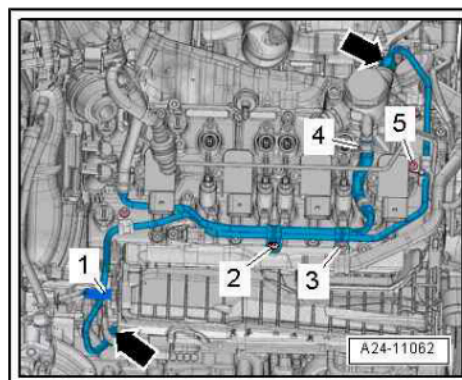
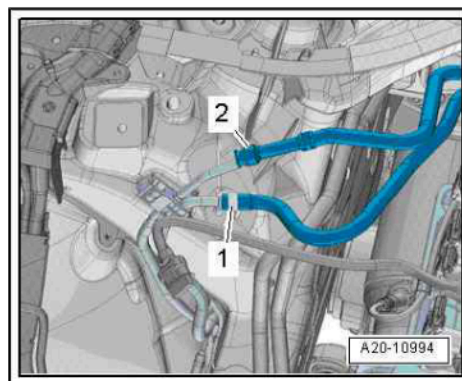
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- Remove bolts -2 and 5-.
- Release hose clip -4- and detach fuel hose.
- Unscrew union nuts -arrows- (counterhold hexagon flats of each connection with an open-end spanner when loosening).
- Detach high-pressure pipe.



Note

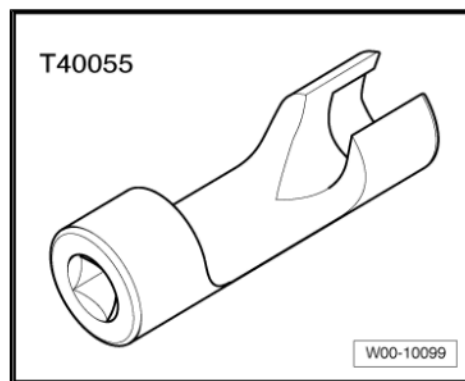
Do not attempt to bend high-pressure pipe to a different shape.



5.3.2 Removing high-pressure pipe (cylinder bank 2, left-side)

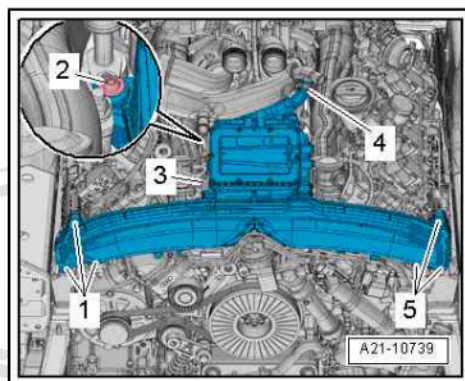
Special tools and workshop equipment required

◆ Socket -T40055-

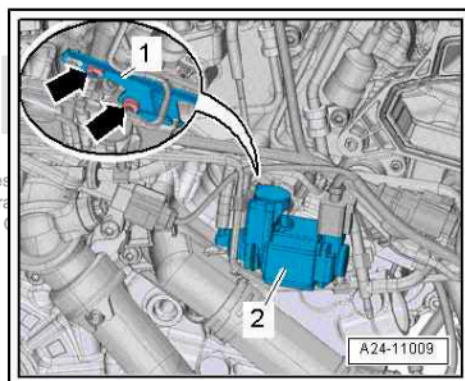


Removing

- Remove charge air cooler housing ⇒ Engine, mechanics;
Rep. gr. 21 .



- Detach charge pressure control solenoid valve -N75-
-item 2- from bracket -1- and push it clear to one side.
- Remove bolts -arrows- and push bracket towards front of vehicle.



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WARNING

Risk of injury caused by fuel.

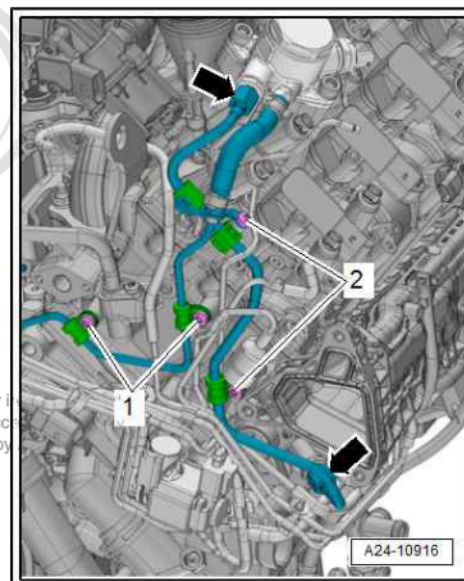
- ◆ *To allow the fuel pressure to dissipate, wrap a clean cloth around the connection and carefully loosen the connection before opening the fuel system.*



Caution

Protect fuel system against contamination.

- ◆ *Observe rules for cleanliness and follow instructions for working on fuel system ➔ [page 4](#).*



- Remove bolts -1 and 2-.
- Unscrew union nuts -arrows- (counterhold hexagon flats of each connection with an open-end spanner when loosening).
- Detach high-pressure pipe.



Note

Do not attempt to bend high-pressure pipe to a different shape.

5.3.3 Installing high-pressure pipe

Installing

Tightening torques:

- Exploded view - intake manifold ➔ [page 23](#) .
- Exploded view - high-pressure pump ➔ [page 45](#) .
- Exploded view - fuel lines ➔ [page 46](#) .



Caution

Risk of leaks.

- ◆ *The connections of the high-pressure pipe must not be damaged.*



Note

Do not attempt to bend high-pressure pipe to a different shape.

- Position retaining clips and rubber dampers as shown in illustrations ➔ [page 46](#) .
- Lubricate threads of union nuts with clean engine oil.
- First tighten union nut by hand until it makes contact, making sure that high-pressure pipe is not under tension.
- Tighten union nut initially to 5 Nm using torque wrench.
- Tighten bolts for retaining clips.



- Tighten union nut to final tightening torque using torque wrench; to do so, counterhold hexagon flats of each connection with an open-end spanner.

Remaining installation steps are carried out in reverse sequence; note the following:

Cylinder bank 1 (right-side):

- Install ignition coil "cylinder 4" ⇒ [page 73](#) .
- Secure drive shaft (right-side) to flange shaft of gearbox ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 40 .
- Install heat shield for drive shaft (right-side) ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Install rear section of front right wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66 .
- Install air cleaner housing ⇒ [page 20](#) .

Cylinder bank 2 (left-side):

- Install charge air cooler housing ⇒ Engine, mechanics; Rep. gr. 21 .



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

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5.4 Removing and installing fuel pressure sender for low pressure -G410-

Removing

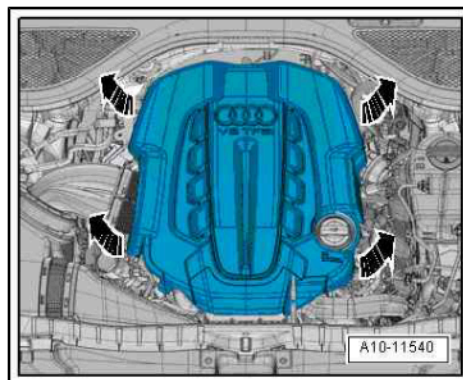


Caution

Protect fuel system against contamination.

- ◆ *Observe rules for cleanliness and follow instructions for working on fuel system ⇒ [page 4](#) .*

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .

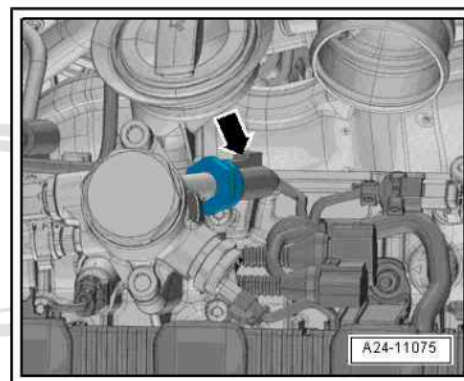


- Unplug electrical connector -arrow-.
- Unscrew fuel pressure sender for low pressure -G410-.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torque: refer to exploded view of high-pressure pump ➔ [page 45](#).
- Install air ducts with screw-type clips ➔ Engine, mechanics; Rep. gr. 21.
- Check fuel system for leaks ➔ [page 5](#).



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

5.5 Removing and installing high-pressure pump

Removing

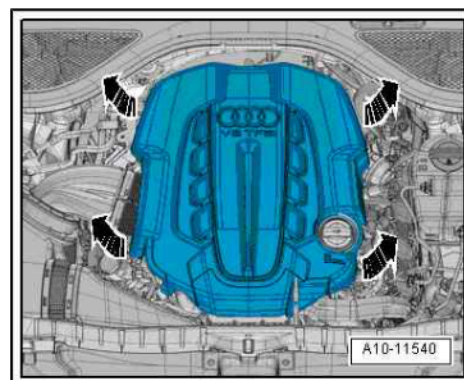
- Remove engine cover panel ➔ Engine, mechanics; Rep. gr. 10.
- Reduce fuel pressure in high-pressure section of injection system ➔ [page 4](#).



WARNING

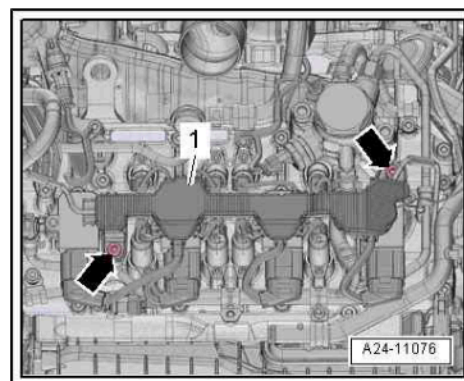
The fuel system operates at extremely high pressure. This can cause injury.

- ◆ *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

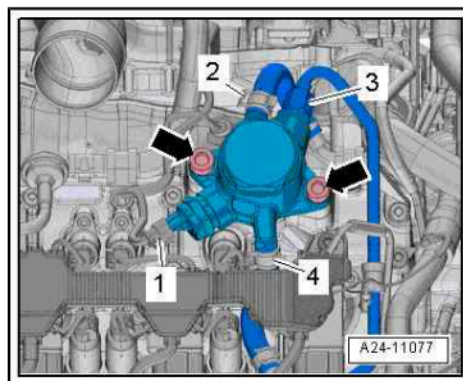


Cylinder bank 1 (right-side):

- Remove air filter element ➔ [page 18](#).
- Remove bolts -arrows- and push wiring guide -1- slightly to right side.



- Unplug electrical connector -1-.
- Release hose clips -2 and 4- and detach fuel hoses.
- Unscrew union nut -3- and bolts -arrows-.
- Remove bolts -arrows-.

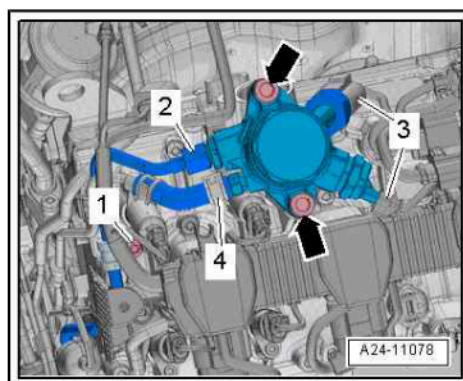


Cylinder bank 2 (left-side):

- Unplug electrical connectors -3-.
- Release hose clip -4- and detach fuel hose.
- Unscrew union nut -2- and bolts -1- and -arrows-.

Continuation for both sides:

- Carefully pull out high-pressure pump. It is possible that the roller tappet may remain lodged inside.



Note

Do not attempt to bend high-pressure pipe to a different shape.

Installing

- Tightening torques: refer to exploded view of high-pressure pump ➔ [page 45](#) .

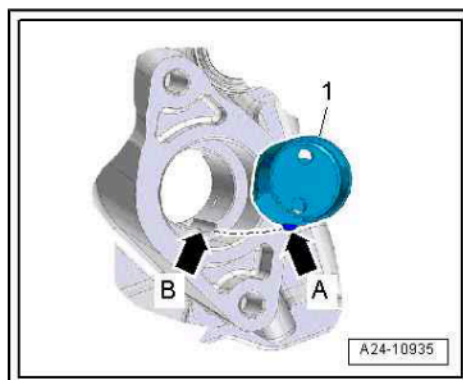


Note

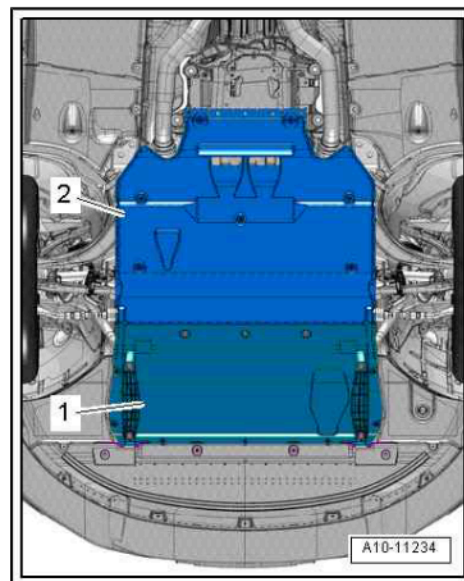
- ◆ *Fit new O-ring.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ➔ Electronic parts catalogue .*
- ◆ *The connections of the high-pressure pipe must not be damaged.*
- ◆ *Do not attempt to bend high-pressure pipe to a different shape.*

- Check roller tappet -1- for damage and renew if necessary.
- Lightly lubricate roller tappet with oil and insert it so that lug -arrow A- slides into guide notch -arrow B-.

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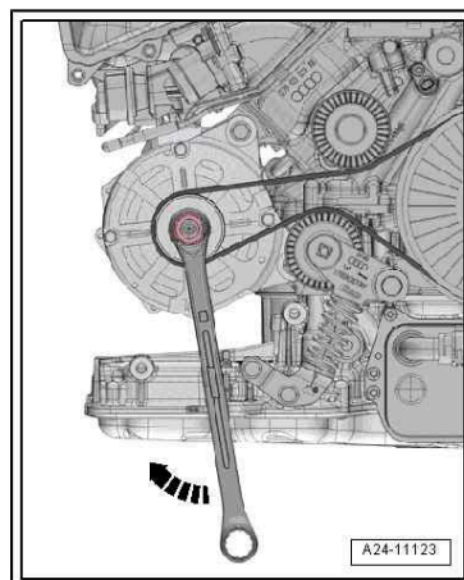
- Install front noise insulation -1- ⇒ General body repairs, exterior; Rep. gr. 66 .



- Rotate crankshaft at alternator in direction of normal engine rotation -arrow- using ring spanner, and at the same time press roller tappet into cylinder head until it reaches its lowest point.

Remaining installation steps are carried out in reverse sequence; note the following:

- Install high-pressure pipe ⇒ [page 53](#) .
- Install air filter element ⇒ [page 18](#) .
- Install air ducts with screw-type clips ⇒ Engine, mechanics; Rep. gr. 21 .
- Check fuel system for leaks ⇒ [page 5](#) .



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ **The engine cover panel must always be fitted before the bonnet is closed.**
- ◆ **If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.**

6 Lambda probes

⇒ ["6.1 Overview - Lambda probes", page 58](#)

⇒ ["6.2 Removing and installing Lambda probes", page 58](#)

6.1 Overview - Lambda probes

1 - Lambda probe after catalytic converter -G130-

- ☐ With Lambda probe 1 heater after catalytic converter -Z29-
- ☐ Removing and installing
⇒ [page 58](#)

2 - Lambda probe 2 -G108- (before catalytic converter)

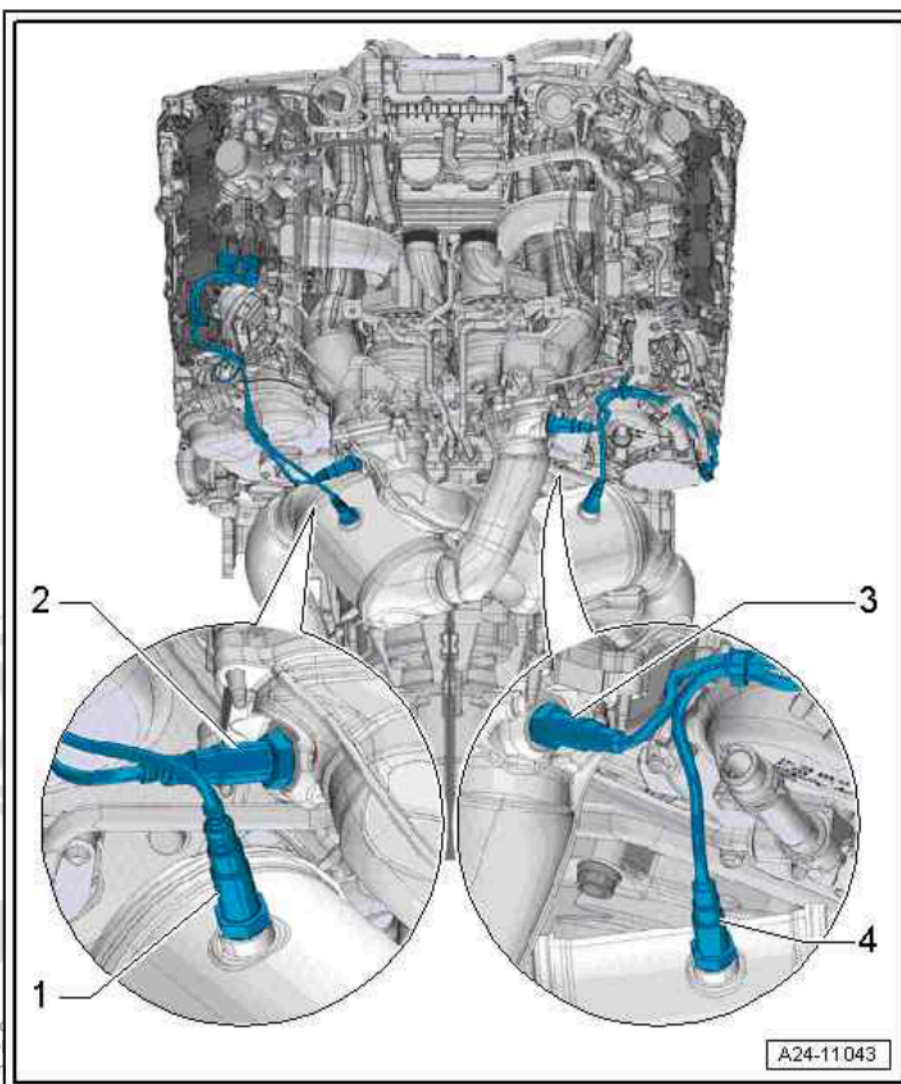
- ☐ With Lambda probe heater 2 -Z28-
- ☐ Removing and installing
⇒ [page 58](#)

3 - Lambda probe -G39- (before catalytic converter)

- ☐ With Lambda probe heater -Z19-
- ☐ Removing and installing
⇒ [page 58](#)

4 - Lambda probe 2 after catalytic converter -G131-

- ☐ With Lambda probe 2 heater after catalytic converter -Z30-
- ☐ Removing and installing
⇒ [page 58](#)



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6.2 Removing and installing Lambda probes

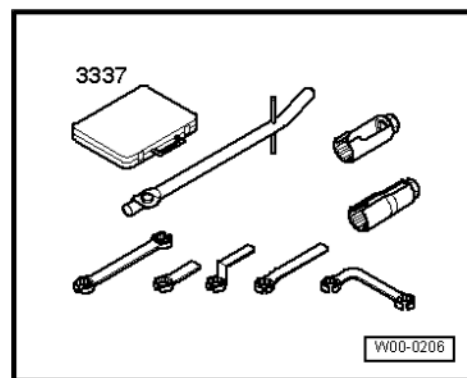
⇒ ["6.2.1 Removing and installing Lambda probes G39 / G131", page 58](#)

⇒ ["6.2.2 Removing and installing Lambda probes G108 / G130", page 60](#)

6.2.1 Removing and installing Lambda probes -G39- / -G131-

Special tools and workshop equipment required

◆ Lambda probe open ring spanner set -3337-



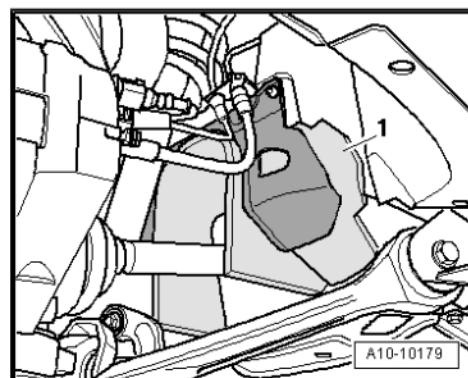
Removing



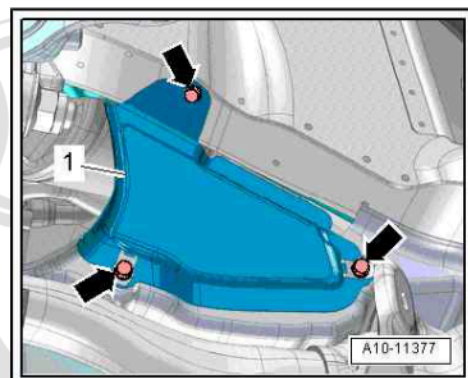
Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

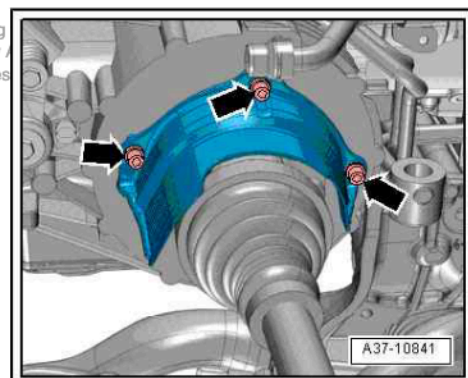
- Remove cover -1- for drive shaft in wheel housing (right-side).



- Remove bolts -arrows- and detach heat shield (right-side) -1-.



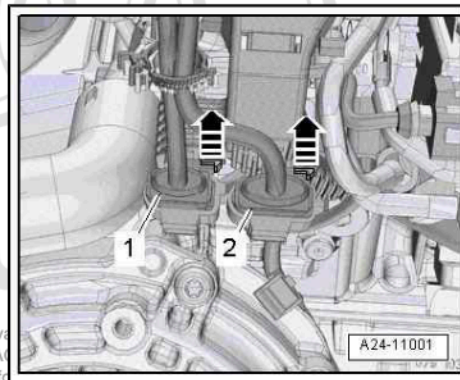
- Remove bolts -arrows- and detach heat shield for drive shaft (right-side).



- Detach electrical connectors from bracket in the sequence shown; release catches -arrows- to unplug connectors and move electrical wiring clear:

2 - For Lambda probe -G39-

1 - For Lambda probe 2 -G131- (after catalytic converter)



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- Unscrew Lambda probes using ring spanner -3337/7- :

1 - Lambda probe 2 after catalytic converter -G131-

2 - Lambda probe -G39-

Installing

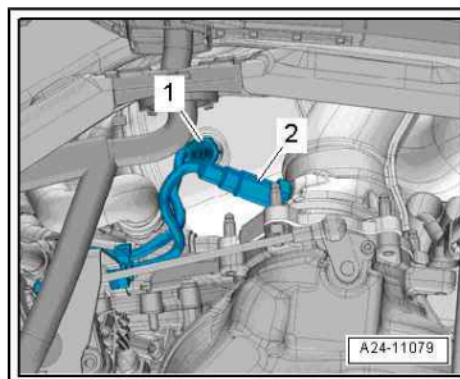
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["6.1 Overview - Lambda probes", page 58](#)



Note

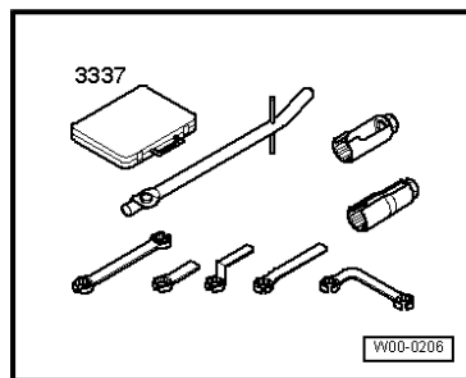
- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*
- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Parts catalogue*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install heat shield for drive shaft (right-side) ⇒ Rep. gr. 34 or ⇒ Rep. gr. 37 .
- Install rear section of front right wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66 .



6.2.2 Removing and installing Lambda probes -G108- / -G130-

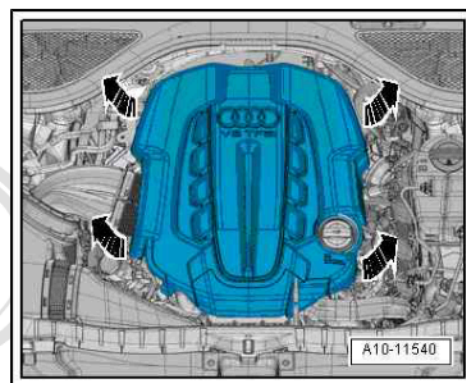
Special tools and workshop equipment required

◆ Lambda probe open ring spanner set -3337-



Removing

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .



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- Detach electrical connectors one after the other from bracket, unplug connectors and move electrical wiring clear:

1 - For Lambda probe after catalytic converter -G130-

4 - For Lambda probe 2 -G108-



Note

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

- Unscrew Lambda probes:

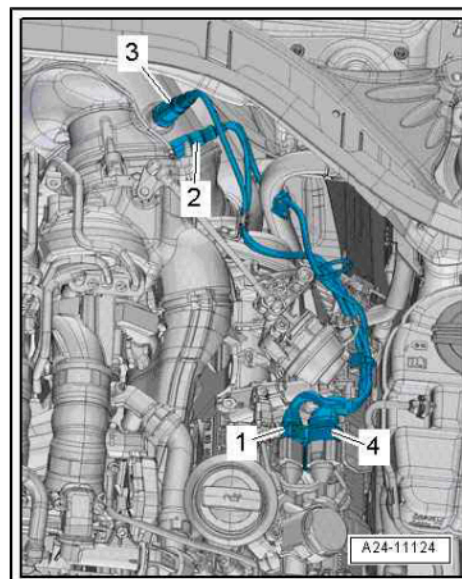
2 - Lambda probe 2 -G108- using ring spanner -3337/7-

3 - Lambda probe after catalytic converter -G130- using ring spanner -3337/3-

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["6.1 Overview - Lambda probes", page 58](#)



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*



Note

- ◆ *Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.*

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- ◆ *In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. High-temperature paste ⇒ Parts catalogue*
- ◆ *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Fit all cable ties in the original positions when installing.*
- Install air ducts with screw-type clips ⇒ Engine, mechanics; Rep. gr. 21 .

7 Engine control unit

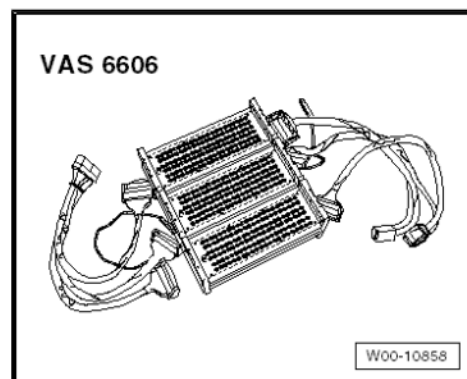
⇒ ["7.1 Wiring and component check with isolator boxes VAS 6606"](#), page 63

⇒ ["7.2 Removing and installing engine control unit J623"](#), page 64

7.1 Wiring and component check with isolator boxes -VAS 6606-

Special tools and workshop equipment required

- ◆ Isolator box, 198-pin -VAS 6606/1-1-



- ◆ Isolator box, 198-pin -VAS 6606/1-2-
- ◆ Isolator box, 198-pin -VAS 6606/1-3-
- ◆ Sheets -VAS 6606/1-1-
- ◆ Sheets -VAS 6606/2-1-
- ◆ Sheets -VAS 6606/3-1-
- ◆ Set of cables -VAS 6606/7-1- and -VAS 6606/7-2-



Note

- ◆ *Always make sure that the cables are properly connected.*
- ◆ *Do not use damaged or worn tools and accessories.*
- ◆ *Observe operating instructions.*

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- Connect both cable sets -VAS 6606/7-1- and -VAS 6606/7-2- to the three isolator boxes -VAS 6606- .
- Use the following sheets:
 - ◆ -VAS 6606/1-1- for isolator box, 198-pin -VAS 6606/1-1-
 - ◆ -VAS 6606/2-1- for isolator box, 198-pin -VAS 6606/1-2-
 - ◆ -VAS 6606/3-1- for isolator box, 198-pin -VAS 6606/1-3-



Note

Make sure that all plug-in bridges are inserted completely in all isolator boxes.

- Connect earth strap to an isolator box and to an earth point on the vehicle.
- Remove engine control unit ⇒ [page 64](#) .

- Connect engine control unit to cable set -VAS 6606/7-1- .
- Connect vehicle wiring harness to cable set -VAS 6606/7-2- .

The connection on the engine control unit consists of a large and a small connector.

The large connector has 105 pins and is assigned to the sheets for the isolator box marked "A 1 to A 105".

The small connector has 91 pins and is assigned to the sheets for the isolator box marked "B 1 to B 91".

When a push-in bridge is pulled out, the corresponding wiring connection is disconnected.



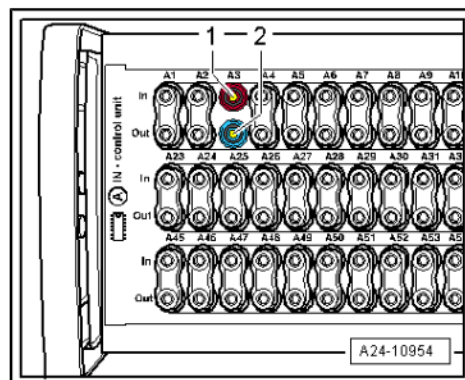
Note

- ♦ The "In" contact -1- (red socket) leads to the engine control unit.
- ♦ The "Out" contact -2- (blue socket) leads to the wiring harness.
- Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

The procedure required after connecting the new engine control unit is described in the Guided Fault Finding or Guided Functions.



Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the event memories of all control units. If this is not successful, the remaining events saved in the memories must be dealt with so that all event memory entries can be erased.

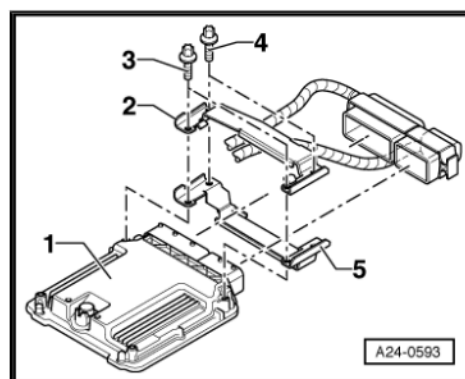
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7.2 Removing and installing engine control unit -J623-



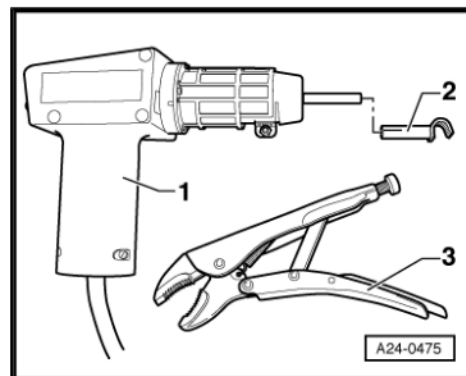
Note

- ♦ Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/gearbox combination.
- ♦ The engine control unit -1- is bolted to a protective casing -2 and 5-. To make it more difficult to unscrew the shear bolts -4- for locking plate -2-, their threads have been coated with locking fluid.
- ♦ The metal locking plate has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).



Special tools and workshop equipment required

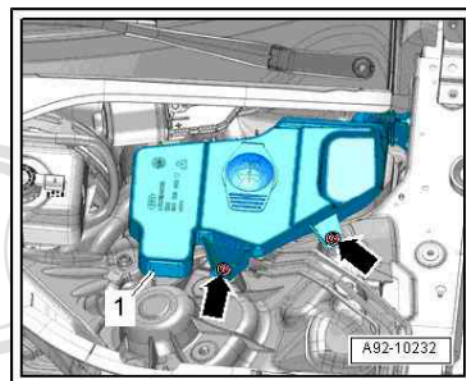
- ◆ Hot air blower -VAS 1978/14A- -item 1- with shrink element for hot air blower -VAS 1978/15A- -2- from wiring harness repair set -VAS 1978B-



- ◆ Small mole grips -3-

Removing

- When renewing engine control unit, select diagnosis object “Replace engine control unit” in “Guided Functions” mode of vehicle diagnostic tester .
- Switch off ignition.
- Remove filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 .



- Release catch -arrow- and detach engine control unit -J623- -item 1-.



Note

Disregard -item 2-.

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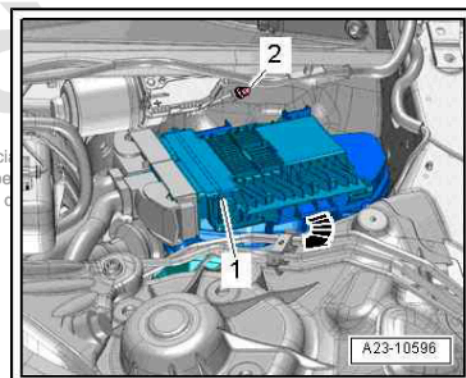
Perform the following work steps if a protective housing is fitted:



Caution

Wiring, connectors, insulation and control units can be burnt and damaged.

- ◆ *Keep exactly to the following procedure. Observe the instructions for operating the hot air blower.*



To help prevent unauthorised access to the connectors on the engine control unit, the engine control unit -1- is bolted to a protective housing -5- by means of shear bolts -3- and 4- and a locking plate -2-.

The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.

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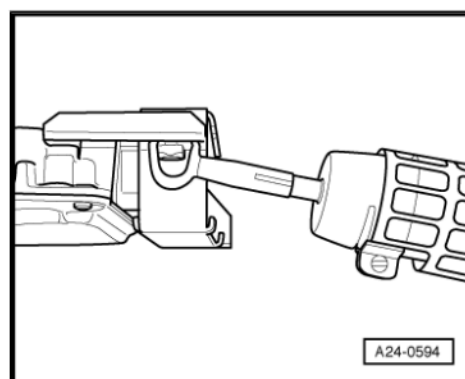
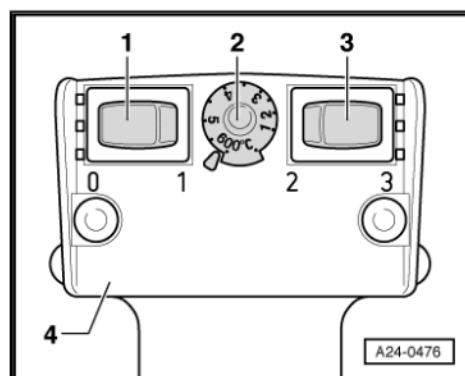
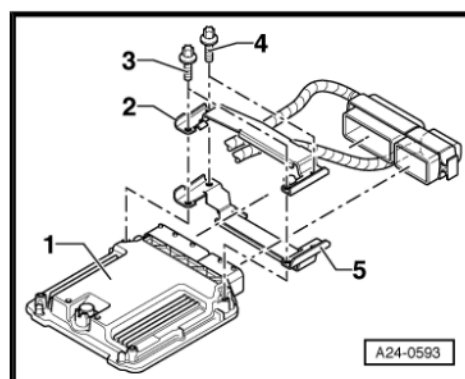
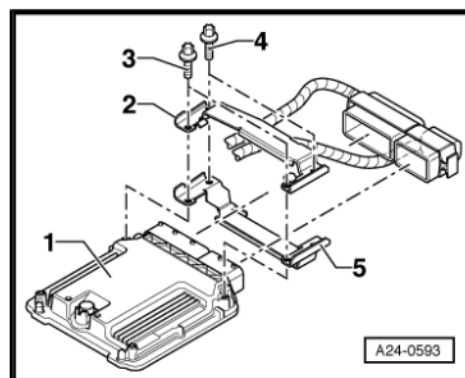
- Select settings on hot air blower as shown in illustration, i.e. set temperature potentiometer -2- to maximum heat output and two-stage air flow switch -3- to position 3.



WARNING

The shear bolts and protective housing also become very hot when heating the threads of the locking mechanism. Take care to avoid burns. It is also important to ensure that only the thread is heated and none of the surrounding components if at all possible. These should be covered if necessary.

- Apply heat to the threads of the shear bolts on the connector side for approx. 25 to 30 seconds.
- Unscrew shear bolts using mole grips (see arrow in illustration).



- The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.
- Detach protective housing from control unit connectors.
- Release connectors on engine control unit and unplug connectors.

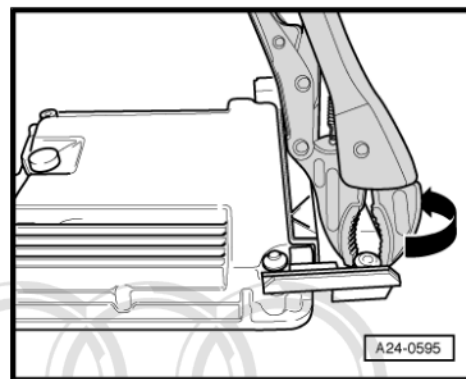
Installing

Installation is carried out in the reverse order; note the following:

- After installation, the protective housing must be re-fitted on the engine control unit -J623- .
- Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
- Always use new shear bolts.
- Install filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 .

After installing a new engine control unit, the following operation must be performed:

- Activate engine control unit via a vehicle diagnostic tester in "Guided Functions" mode, "Replace engine control unit"



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28 – Ignition system

1 General notes and safety precautions

⇒ "1.1 General notes on ignition system", page 68

⇒ "1.2 Safety precautions when working on the injection and ignition system", page 68

⇒ "1.3 Safety precautions when working on vehicles with start/stop system", page 69

⇒ "1.4 Safety precautions after working in the engine compartment", page 69

⇒ "1.5 Safety precautions when using testers and measuring instruments during a road test", page 70

1.1 General notes on ignition system

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- ◆ The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated. The vacuum hoses and connections must also be checked (unmetered air).
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ Entries will be stored in the event memory of the engine control unit if electrical connectors have been unplugged and the engine started.
- ◆ If the engine starts, runs for a short period and then cuts out after completing fault finding, repairs or component tests, this may be due to the immobilizer disabling the engine control unit. The event memory of the engine control unit must then be interrogated and, if necessary, the control unit must be adapted.

Additional steps required

- Erase any entries in event memory resulting from testing or repairs ⇒ Vehicle diagnostic tester, Guided Functions, Interrogate event memory, then Generate readiness code.

1.2 Safety precautions when working on the injection and ignition system

To prevent injuries to persons and/or damage to the fuel injection and ignition system, note the following:

- ◆ Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.
- ◆ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- ◆ For safety reasons, the battery must be disconnected before opening the fuel system to prevent the fuel pump from being activated by the contact switch on the driver's door.
- ◆ Do not open any fuel line connections while the engine is running.
- ◆ Always switch off ignition before washing engine.



Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

- ◆ *Observe notes on procedure for disconnecting the battery.*
- ◆ *Always switch off the ignition before disconnecting the battery.*

– Disconnect battery ⇒ Electrical system; Rep. gr. 27 .

1.3 Safety precautions when working on vehicles with start/stop system



WARNING

Risk of injury due to automatic engine start on vehicles with start/stop system.

- ◆ *On vehicles with activated start/stop system (this is indicated by a message in the instrument cluster display), the engine may start automatically on demand.*
- ◆ *Therefore it is important to ensure that the start/stop system is deactivated when performing repairs (switch off ignition, if required switch on ignition again).*

1.4 Safety precautions after working in the engine compartment

After working in the engine compartment, note the following:



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

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1.5 Safety precautions when using testers and measuring instruments during a road test

Note the following if testers and measuring instruments have to be used during a road test:



WARNING

Accidents can be caused if the driver is distracted by test equipment while road-testing, or if test equipment is not properly secured.

Persons sitting in the front passenger's seat could be injured if the airbag is triggered in an accident.

- *The use of test equipment while driving causes distraction.*
- *There is an increased risk of injury if test equipment is not secured.*
- ◆ *Test equipment must always be secured on the rear seat with a strap and operated from the rear seat by a second person.*



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2 Servicing ignition system

⇒ ["2.1 Test data", page 71](#)

⇒ ["2.2 Ignition system - exploded view", page 72](#)

⇒ ["2.3 Removing and installing ignition coils", page 73](#)

⇒ ["2.4 Removing and installing knock sensors", page 77](#)

⇒ ["2.5 Removing and installing Hall senders", page 83](#)

⇒ ["2.6 Removing and installing engine speed sender G28", page 87](#)

2.1 Test data

Test data		4.0 ltr. TFSI engine
Idling speed		Cannot be adjusted; regulated by idling speed stabilisation
Ignition timing		Not adjustable (determined by control unit)
Ignition system		Multi-coil system with 8 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Data sheets for exhaust emissions test
	Tightening torque	⇒ Maintenance ; Booklet 411
Firing order		1-5-4-8-6-3-7-2



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2.2 Ignition system - exploded view

1 - Knock sensor

- ☐ Cylinder bank 1 (right-side)
- ☐ Knock sensor 1 -G61- (front)
- ☐ Knock sensor 2 -G66- (rear)
- ☐ Removing and installing ⇒ [page 77](#)

2 - Bolt

- ☐ 25 Nm
- ☐ The tightening torque influences the function of the knock sensor

3 - O-ring

- ☐ Renew

4 - Hall sender

- ☐ Inlet side: Hall sender -G40-
- ☐ Exhaust side: Hall sender 2 -G163-
- ☐ Removing and installing ⇒ [page 83](#)

5 - Bolt

- ☐ 9 Nm

6 - Spark plug

- ☐ Change interval ⇒ Maintenance tables
- ☐ Tightening torque ⇒ Maintenance ; Booklet 411

7 - Ignition coil

- ☐ Removing and installing ⇒ [page 73](#)

8 - Bolt

- ☐ 9 Nm

9 - Cable guide

10 - Bolt

- ☐ 5 Nm

11 - Engine speed sender -G28-

- ☐ Removing and installing ⇒ [page 87](#)

12 - Bolt

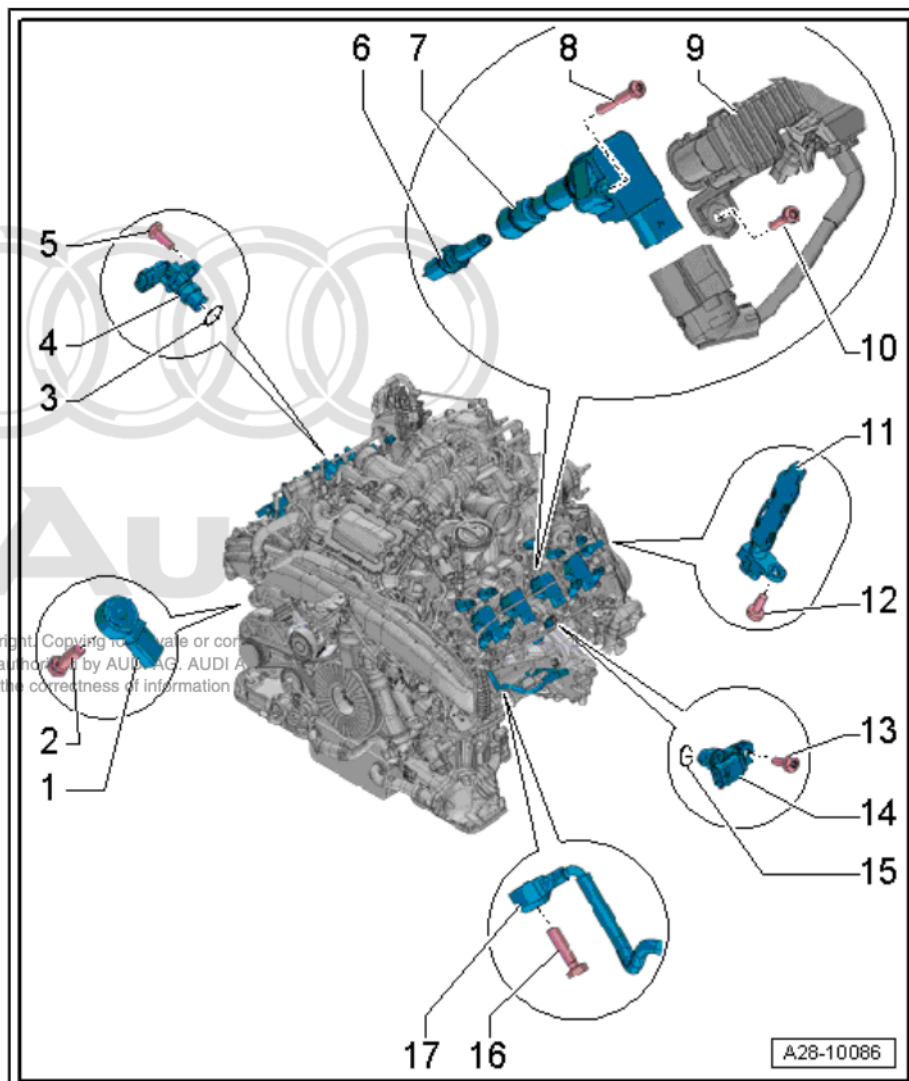
- ☐ 9 Nm

13 - Bolt

- ☐ 9 Nm

14 - Hall sender

- ☐ Inlet side: Hall sender 3 -G300-
- ☐ Exhaust side: Hall sender 4 -G301-
- ☐ Removing and installing ⇒ [page 85](#)



15 - O-ring

- ☐ Renew

16 - Bolt

- ☐ 25 Nm
- ☐ The tightening torque influences the function of the knock sensor

17 - Knock sensor

- ☐ Cylinder bank 2 (left-side)
- ☐ Knock sensor 3 -G198- (front)
- ☐ Knock sensor 4 -G199- (rear)
- ☐ Removing and installing ⇒ [page 77](#)

2.3 Removing and installing ignition coils

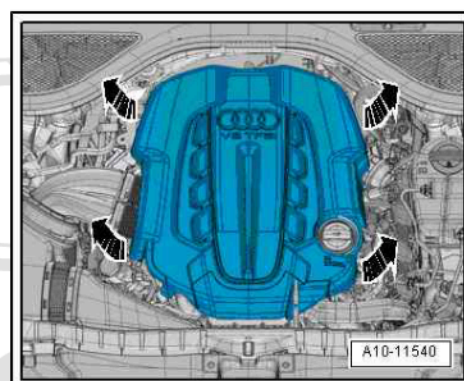
⇒ [“2.3.1 Removing and installing ignition coils N70 / N127 / N291 / N292 \(cylinder bank 1 right-side\)”, page 73](#)

⇒ [“2.3.2 Removing and installing ignition coils N323 / N324 / N325 / N326 \(cylinder bank 2 left-side\)”, page 74](#)

2.3.1 Removing and installing ignition coils - N70- / -N127- / -N291- / -N292- (cylinder bank 1 right-side)

Removing

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .
- Remove air cleaner housing ⇒ [page 20](#) .



- Unplug electrical connectors and move wiring clear:

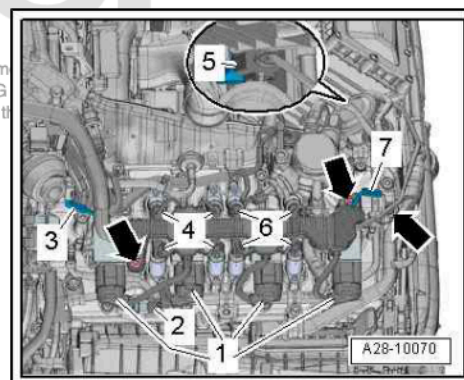
1 - For ignition coils -N70- , -N127- , -N291- , -N292-
2 - For Hall sender -G40-

4 - For inlet and exhaust cam actuators -F456- , -F457- , -F458- , -F459-

5 - For intake air temperature sender -G42-

6 - For inlet and exhaust cam actuators -F452- , -F453- , -F454- , -F455-

- Disconnect vacuum hoses -3, 7-.
- Remove bolts -arrows-.
- Move earth wire clear and pivot wiring guide towards rear.



- Remove bolt -arrow- and pull off relevant ignition coil -1-.

Installing

- Tightening torques
⇒ ["2.2 Ignition system - exploded view", page 72](#)



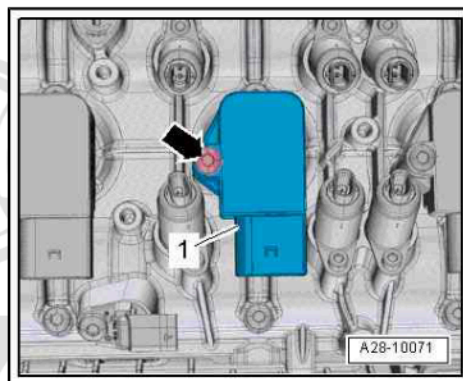
Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue* .

- Align ignition coils with recesses in cylinder head cover.
- Press ignition coils onto spark plugs by hand (do NOT use tool).

Remaining installation steps are carried out in reverse **sequence**; note the following:

- Install air cleaner housing ⇒ [page 20](#) .
- Install air ducts with screw-type clips ⇒ Engine, mechanics; Rep. gr. 21 .



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WARNING

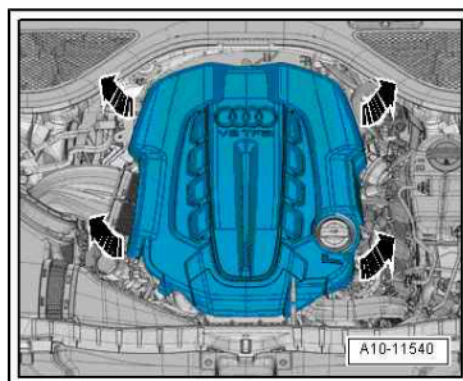
Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

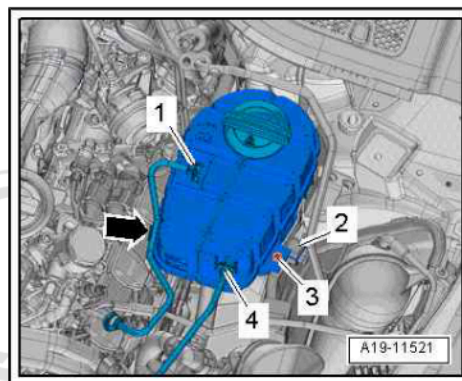
2.3.2 Removing and installing ignition coils - N323- / -N324- / -N325- / -N326- (cylinder bank 2 left-side)

Removing

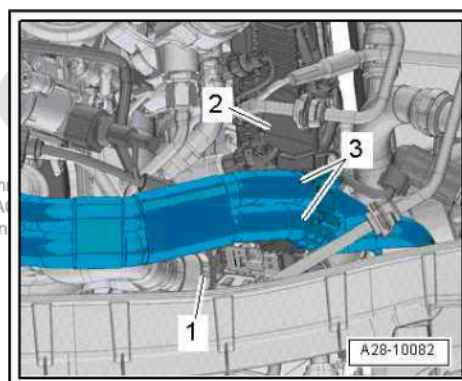
- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .



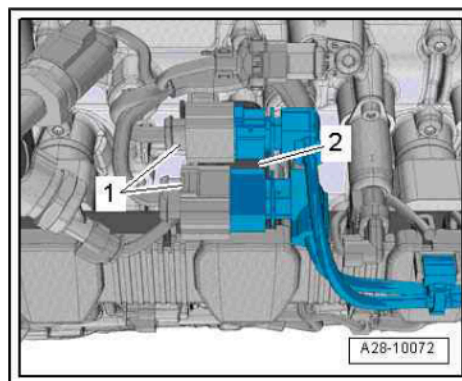
- Lift retaining clips -1, 4- and disconnect coolant hoses.
- Move coolant hose clear -arrow-.
- Unplug electrical connector -2-.
- Remove bolt -3-.
- Lift coolant expansion tank out of bracket and push towards front.



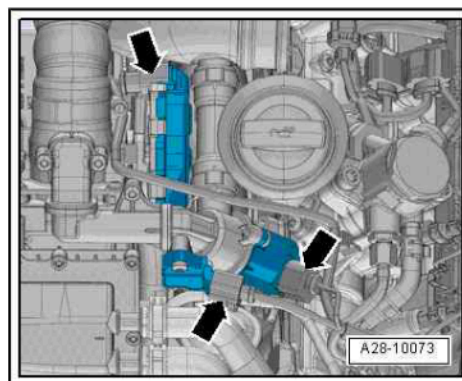
- Move coolant hoses -3- and air hose -1- clear at wiring guide -2-.



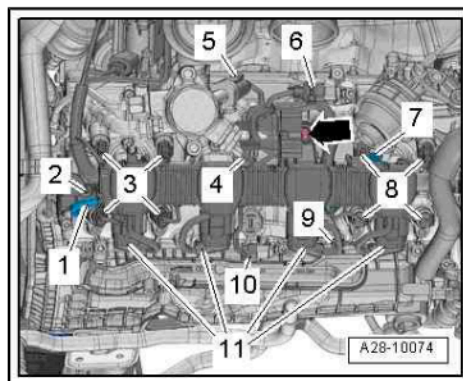
- Take electrical connectors -1- out of bracket -2-, unplug them and move electrical wiring clear.
- Lift out bracket.



- Unplug electrical connectors -arrows- and move clear.



- Unplug electrical connectors and move wiring clear:
- 3 - For inlet and exhaust cam actuators -F464-, -F465-, -F466-, -F467-
- 4 - For fuel metering valve 2 -N402-
- 5 - For fuel pressure sender for low pressure -G410-
- 6 - For Hall sender 4 -G301-
- 8 - For inlet and exhaust cam actuators -F476-, -F477-, -F478-, -F479-
- 10 - For Hall sender 2 -G163-
- 11 - For ignition coils -N323-, -N324-, -N325-, -N326-
- Disconnect vacuum hoses -1, 7-.
- Remove bolts -2, 9- and centre hex stud -arrow-, move earth wire clear and pivot wiring guide towards rear.
- Remove bolt -arrow- and pull off relevant ignition coil -1-.



Installing

- Tightening torques
⇒ "2.2 Ignition system - exploded view", page 72

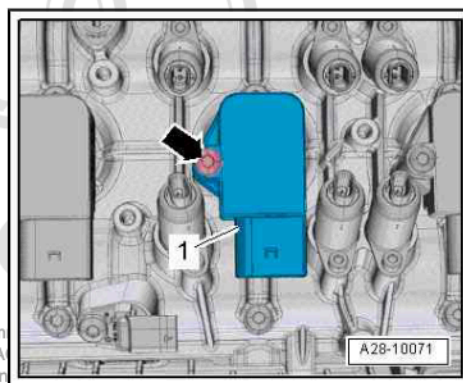


Note

Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Electronic parts catalogue*.

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- Align ignition coils with recesses in cylinder head cover.
- Press ignition coils onto spark plugs by hand (do NOT use tool).



Remaining installation steps are carried out in reverse sequence; note the following:

- Install air ducts with screw-type clips ⇒ Engine, mechanics; Rep. gr. 21.



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ The engine cover panel must always be fitted before the bonnet is closed.
- ◆ If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.

2.4 Removing and installing knock sensors

⇒ [“2.4.2 Removing and installing knock sensor G61 \(cylinder bank 1, right-side\) - A7 only”, page 79](#)

⇒ [“2.4.3 Removing and installing knock sensor 2 G66 \(cylinder bank 1, right-side\)”, page 79](#)

⇒ [“2.4.4 Removing and installing knock sensor 3 G198 \(cylinder bank 2, left-side\)”, page 81](#)

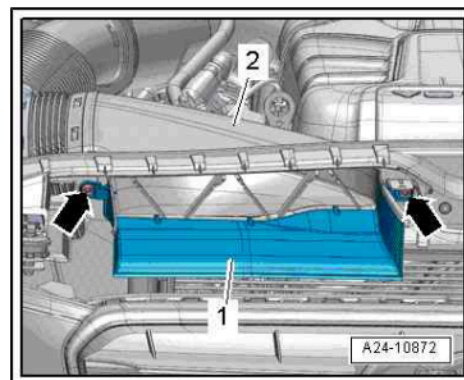
⇒ [“2.4.5 Removing and installing knock sensor 4 G199 \(cylinder bank 2, left-side\)”, page 82](#)

2.4.1 Removing and installing knock sensor - G61- (cylinder bank 1, right-side) - A6 only

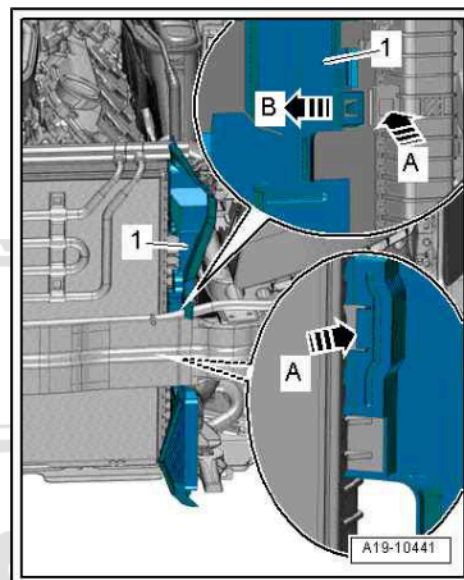
Fitting location

⇒ [“2.2.4 Fitting locations on engine \(from right side\)”, page 15](#)

- Disconnect earth wire at battery with ignition switched off.
- Remove bolts -arrows- and detach air duct -2-.

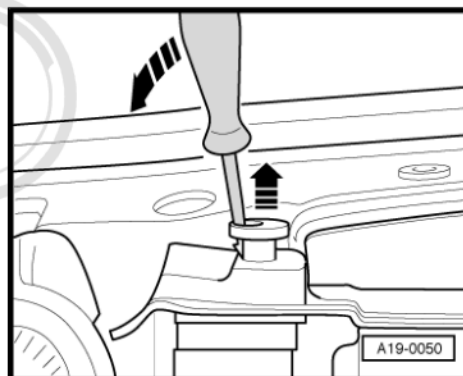


- Release catches -arrows A- and detach air duct -1- on left and right -arrow B-.



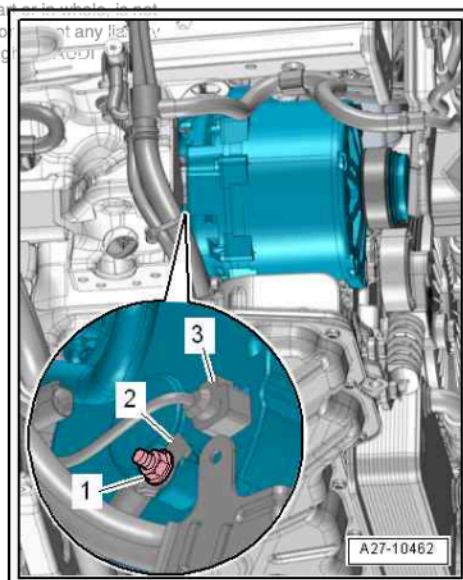
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- Release retaining pins for radiator on both sides and pull out upwards -arrows-.
- Push radiator towards the front.
- Remove tensioner for poly V-belt ➔ Rep. gr. 13 .

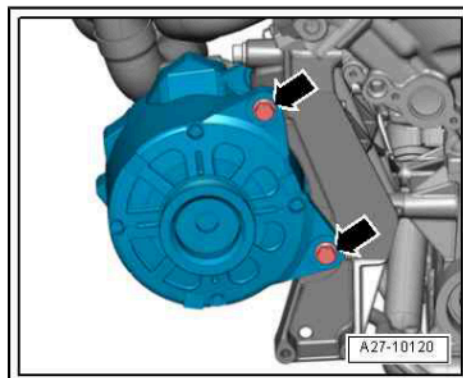


- Unplug electrical connector -3-.

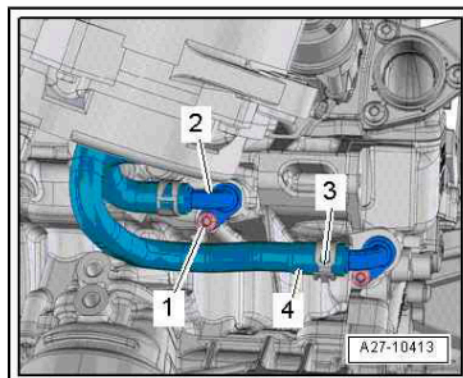
- Remove nut -1- and detach B+ wire -2-.



- Unscrew bolts -arrows- for alternator approx. 6 turns.
- Tap carefully on bolt heads with a hammer to release sliding bushes of alternator mountings.
- Remove bolts completely.
- If fitted, remove silencer for auxiliary heater ➔ Rep. gr. 82 .
- Move alternator as far as possible to the right.



- Loosen bolts and detach coolant hoses -2 and 4- with connections.



- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove knock sensor 1 -G61- .

Installing

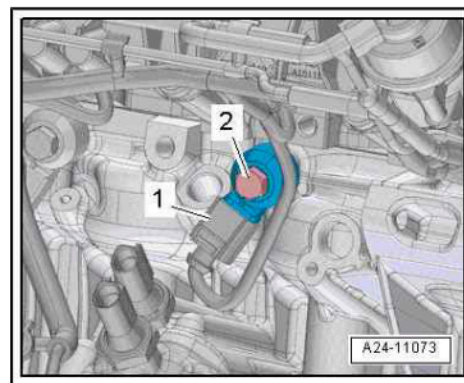
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["2.2 Ignition system - exploded view", page 72](#)



Note

The tightening torque influences the function of the knock sensor.



- Install alternator ⇒ Electrical system; Rep. gr. 27 .

2.4.2 Removing and installing knock sensor - G61- (cylinder bank 1, right-side) - A7 only

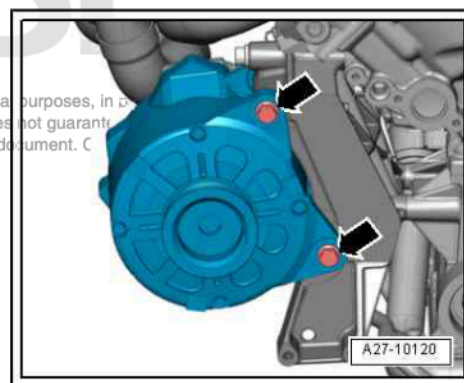
Fitting location

⇒ ["2.2.4 Fitting locations on engine \(from right side\)", page 15](#)

Removing

- Disconnect earth wire at battery with ignition switched off.
- Remove alternator ⇒ Electrical system; Rep. gr. 27 .

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- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove knock sensor 1 -G61- .

Installing

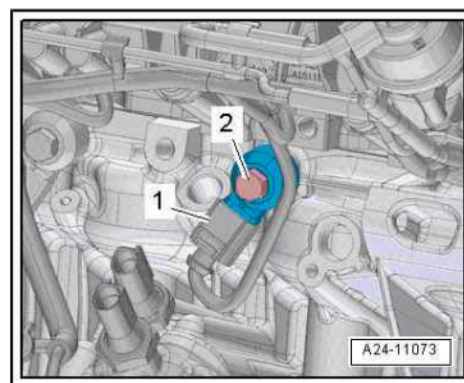
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["2.2 Ignition system - exploded view", page 72](#)



Note

The tightening torque influences the function of the knock sensor.



- Install alternator ⇒ Electrical system; Rep. gr. 27 .

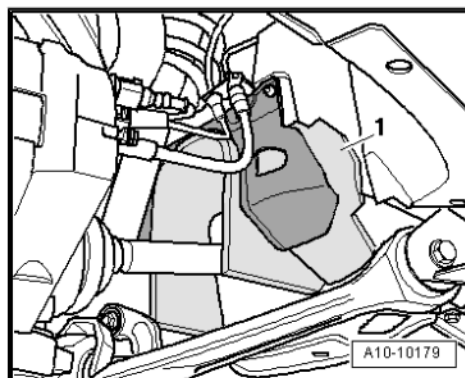
2.4.3 Removing and installing knock sensor 2 -G66- (cylinder bank 1, right-side)

Fitting locations

⇒ ["2.2 Overview of fitting locations - injection system", page 8](#)

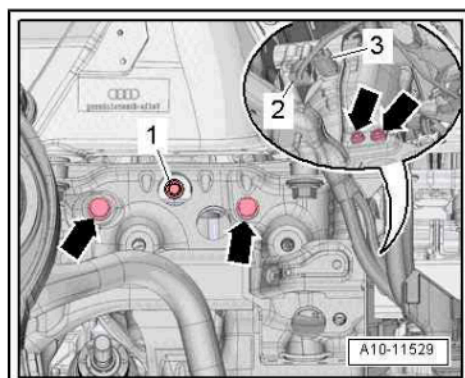
Removing

- Remove front wheel (right-side) ➔ Wheels and tyres; Rep. gr. 44 .
- Remove cover -1- for drive shaft in wheel housing (right-side).

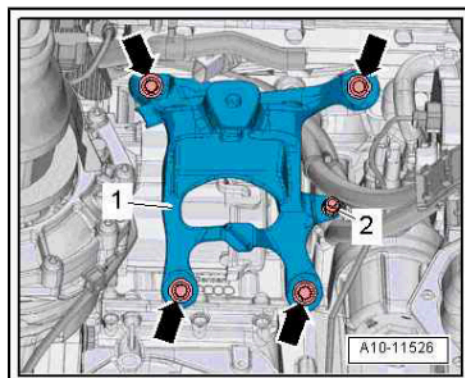


- Remove engine mounting (right-side) ➔ Engine, mechanics; Rep. gr. 10 .

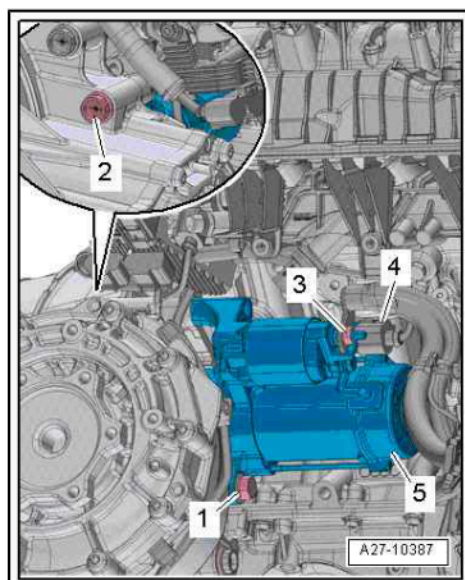
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- Remove nut -2- and move earth wire clear.
- Remove bolts -arrows- and detach engine support -1- (right-side).



- Unplug electrical connector -4- from starter (push retainer to rear and press down release catch).
- Unfasten nut -3- and detach battery positive wire from solenoid switch.



- Unplug electrical connector -1-.
- Unscrew bolt -2- and remove knock sensor 2 -G66-.

Installing

Installation is carried out in the reverse order; note the following:

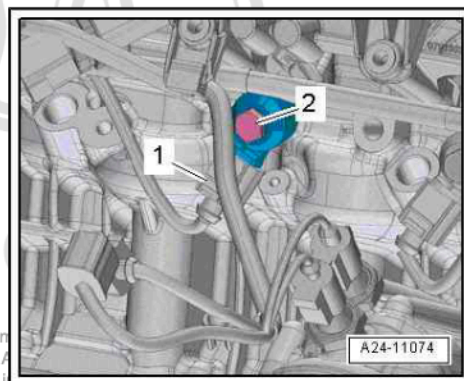
- Tightening torques
⇒ ["2.2 Ignition system - exploded view", page 72](#)



Note

The tightening torque influences the function of the knock sensor.

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- Install engine support and engine mounting (right-side) ⇒ Engine, mechanics; Rep. gr. 10.
- Install rear section of front right wheel housing liner ⇒ General body repairs, exterior; Rep. gr. 66.

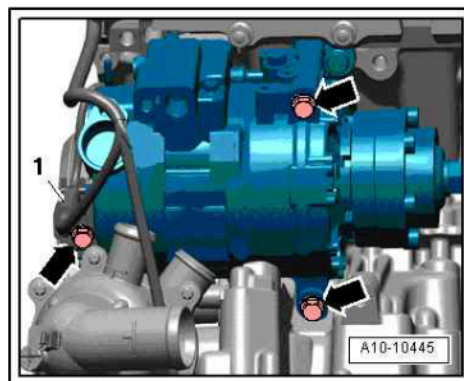
2.4.4 Removing and installing knock sensor 3 -G198- (cylinder bank 2, left-side)

Fitting location

⇒ ["2.2.5 Fitting locations on engine \(from left side\)", page 16](#)

Removing

- Remove air conditioner compressor ⇒ Air conditioning system; Rep. gr. 87.



- Detach electrical connector -2- from bracket and unplug.
- Unscrew bolt -1- and remove knock sensor 3 -G198-.



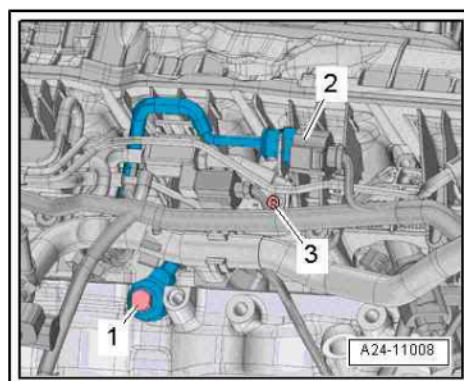
Note

Disregard -item 3-.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["2.2 Ignition system - exploded view", page 72](#)



Note

The tightening torque influences the function of the knock sensor.

- Install air conditioner compressor ⇒ Air conditioning system; Rep. gr. 87.

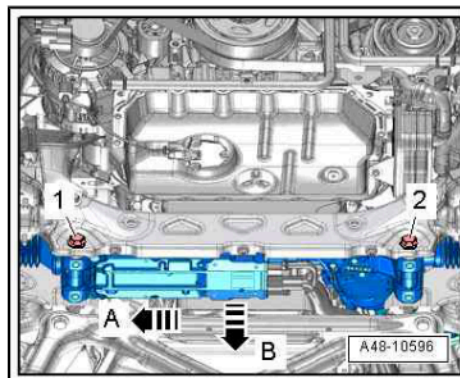
2.4.5 Removing and installing knock sensor 4 -G199- (cylinder bank 2, left-side)

Fitting location

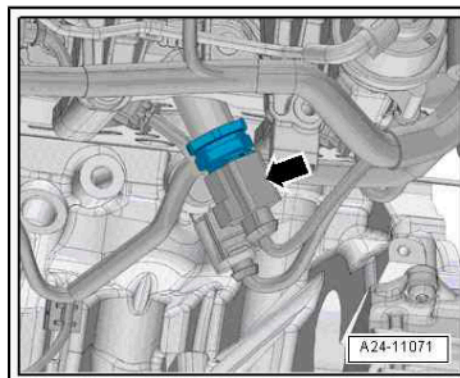
⇒ ["2.2.5 Fitting locations on engine \(from left side\)", page 16](#)

Removing

- Remove electromechanical steering rack ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 48 .



- Unplug electrical connector -arrow-.



- Remove bolt -2-.
- Detach knock sensor 4 -G199- and unplug electrical connector -1-.

Installing

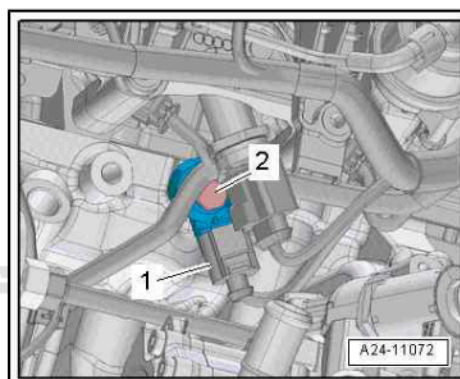
Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["2.2 Ignition system - exploded view", page 72](#)



Note

The tightening torque influences the function of the knock sensor.



- Install electromechanical steering rack ⇒ Running gear, front-wheel drive and four-wheel drive; Rep. gr. 48 .

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2.5 Removing and installing Hall senders

⇒ [“2.5.1 Removing and installing Hall sender G40 \(cylinder bank 1, right-side\)”, page 83](#)

⇒ [“2.5.2 Removing and installing Hall sender 2 G163 \(cylinder bank 1, right-side\)”, page 83](#)

⇒ [“2.5.3 Removing and installing Hall sender G300 / G301 \(cylinder bank 2, left-side\)”, page 85](#)

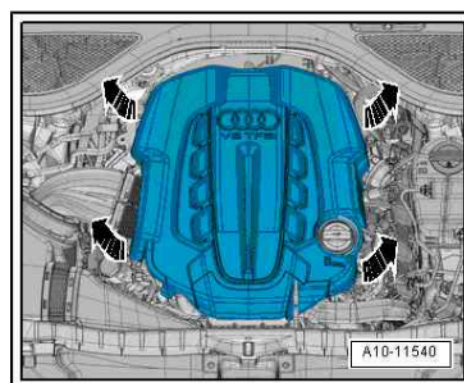
2.5.1 Removing and installing Hall sender - G40- (cylinder bank 1, right-side)

Fitting locations

⇒ [“2.2 Overview of fitting locations - injection system”, page 8](#)

Removing

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .
- Remove air filter element ⇒ [page 18](#) .

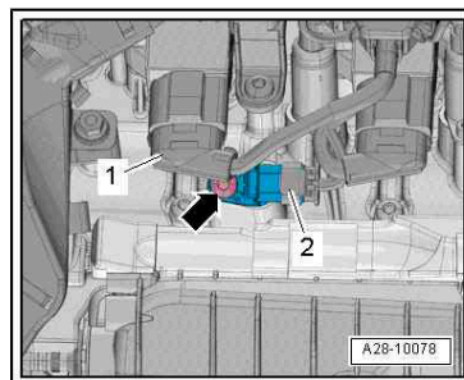


- Unplug electrical connectors:
 - 1 - For Ignition coil 4 with output stage -N292-
 - 2 - For Hall sender -G40-
- Unscrew bolt -arrow- and remove Hall sender.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ [“2.2 Ignition system - exploded view”, page 72](#)



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

2.5.2 Removing and installing Hall sender 2 - G163- (cylinder bank 1, right-side)

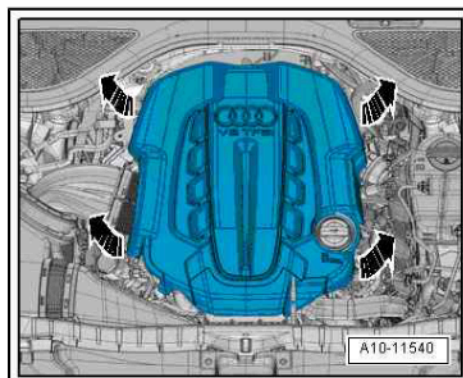
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Fitting locations

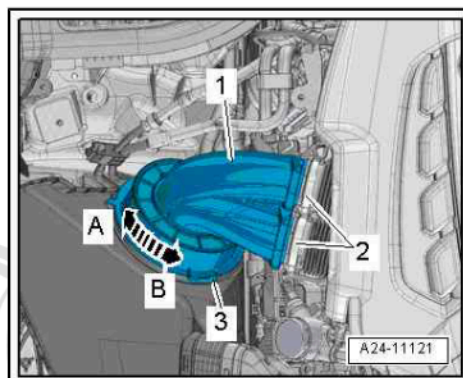
⇒ [“2.2 Overview of fitting locations - injection system”, page 8](#)

Removing

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10.



- Remove air cleaner (top section) -1-.



- Release hose clip -1- and disconnect hose from activated charcoal filter.

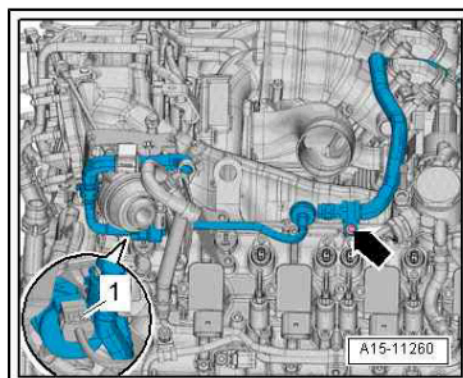


Note

Disregard -item 2-.

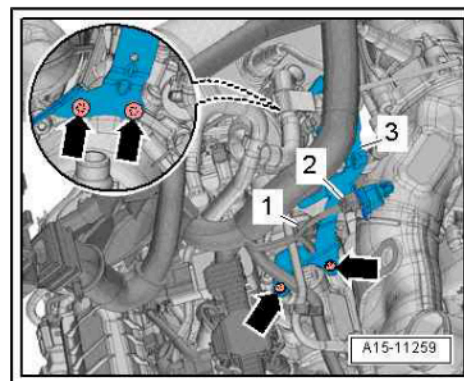


- Unplug electrical connector -1- at activated charcoal filter system solenoid valve 1 -N80-.
- Remove bolt -arrow-.



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- Unplug electrical connectors -1, 2-.
- Remove bolts -arrows- and move bracket -3- with electrical wiring harness to one side.

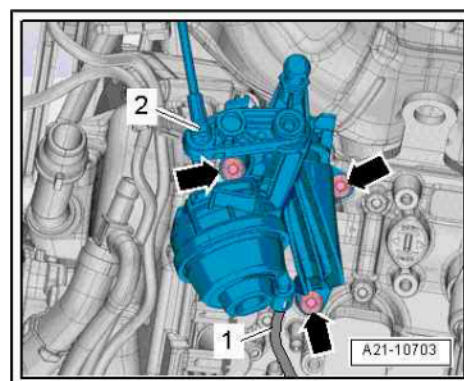


- Disconnect vacuum hose -1-.
- Remove bolts -arrows- and place vacuum unit for turbocharger to one side.



Note

Disregard -item 2-.

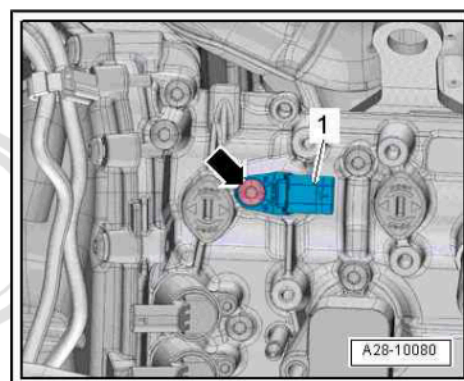


- Unscrew bolt -arrow- and remove Hall sender -1-.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ ["2.2 Ignition system - exploded view", page 72](#)



WARNING

Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

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2.5.3 Removing and installing Hall sender - G300- / -G301- (cylinder bank 2, left-side)

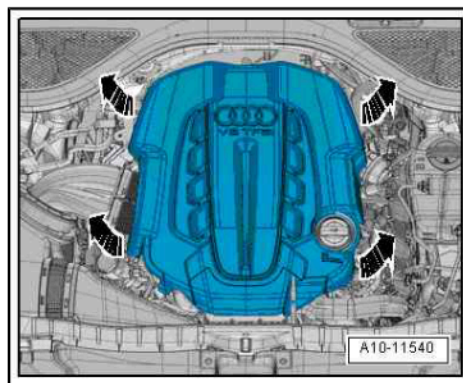
Removing

Fitting locations

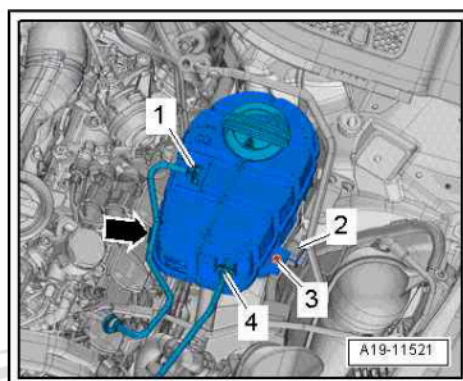
⇒ ["2.2 Overview of fitting locations - injection system", page 8](#)

Hall sender 3 -G300- :

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .

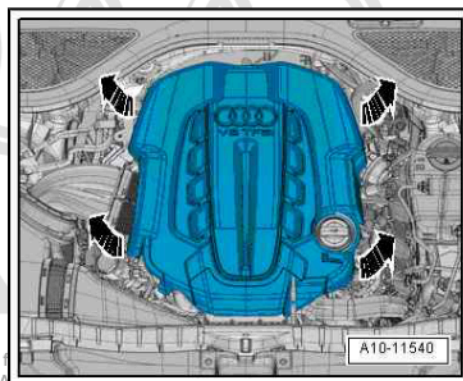


- Lift retaining clips -1, 4- and disconnect coolant hoses.
- Move coolant hose clear -arrow-.
- Unplug electrical connector -2-.
- Remove bolt -3-.
- Lift coolant expansion tank out of bracket and push towards front.



Hall sender 4 -G301- :

- Remove engine cover panel ⇒ Engine, mechanics; Rep. gr. 10 .



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Continuation for both Hall senders:

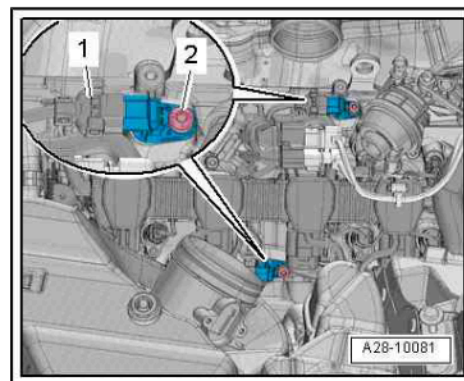
- Unplug relevant electrical connector -1-.
- Unscrew bolt -2- and detach relevant Hall sender.

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torques
⇒ "2.2 Ignition system - exploded view", page 72

If Hall sender 3 -G300- was removed, coolant level must be checked ⇒ Rep. gr. 19 .



WARNING

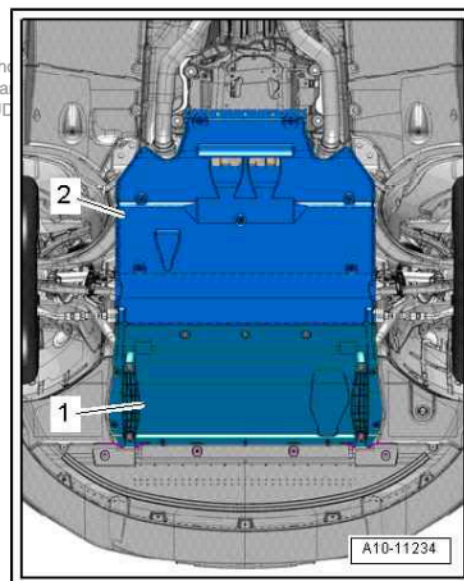
Danger of fire and damage if the engine cover panel is not fitted.

- ◆ *The engine cover panel must always be fitted before the bonnet is closed.*
- ◆ *If the engine cover panel is not fitted, it is not permissible to start or drive the vehicle with the bonnet closed.*

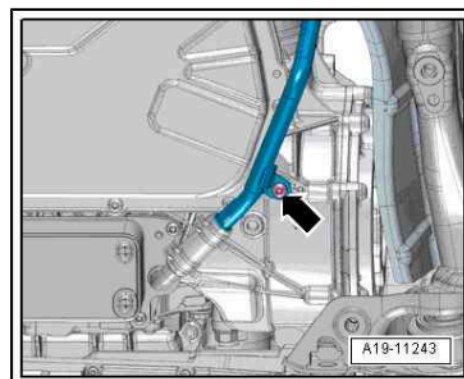
2.6 Removing and installing engine speed sender -G28-

Removing

- Remove rear noise insulation panel -2- ⇒ Rep. gr. 66



- Remove bolt -arrow- for coolant pipe on gearbox (right-side).

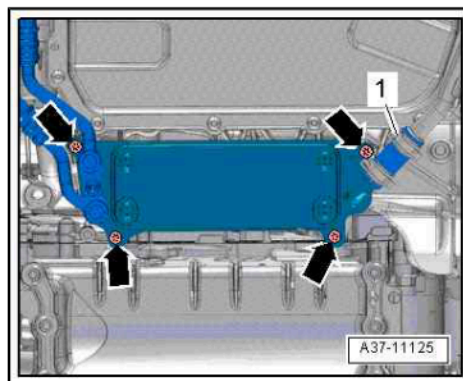


- Remove bolts -arrows- and push ATF cooler slightly to one side.



Note

Disregard -item 1-.

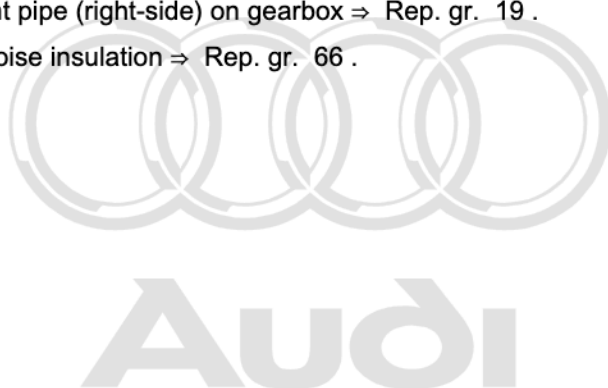
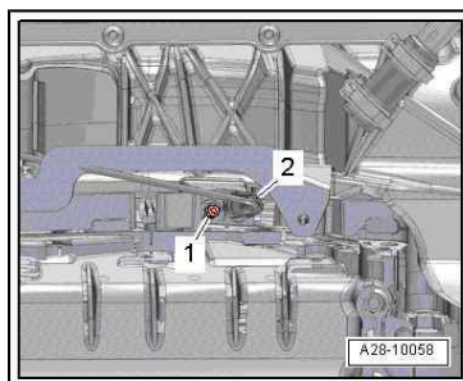


- Unplug electrical connector -2-.
- Unscrew bolt -1- and pull out engine speed sender -G28- .

Installing

Installation is carried out in the reverse order; note the following:

- Tightening torque
⇒ ["2.2 Ignition system - exploded view", page 72](#)
- Install ATF cooler ⇒ Rep. gr. 34 .
- Install coolant pipe (right-side) on gearbox ⇒ Rep. gr. 19 .
- Install rear noise insulation ⇒ Rep. gr. 66 .



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